WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

FEBRUARY, 1953

Los Angeles' $42,000,000 Activated Sludge Plant
Went into full scale operation in 1953.

Complete Seating Contact!

You know you've got it with . . .

CHAPMAN

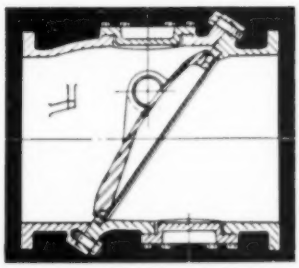
Exclusive TILTING DISC *Check Valve*

Nothing can "unseat" the disc-ring of this valve from its *drop-tight* contact with the body-ring . . . because clearance at the hinge-pins means that this contact is *complete.* There is no sliding action, consequently no wear, no leakage. And the pivoted disc is cushioned to an easy, silent closing . . . without slam . . . in installations that don't have unusual piping arrangements.

What's more, hydraulic laboratory tests at a top engineering school prove that the specially designed disc and streamlined valve-body reduce head loss as much as 80% under conventional swing-type check valves. See the graphs of these tests . . . and illustrations of the unique construction features of Chapman Tilting Disc Check Valves . . . in Catalog No. 30 (yours for the asking). *Write.*

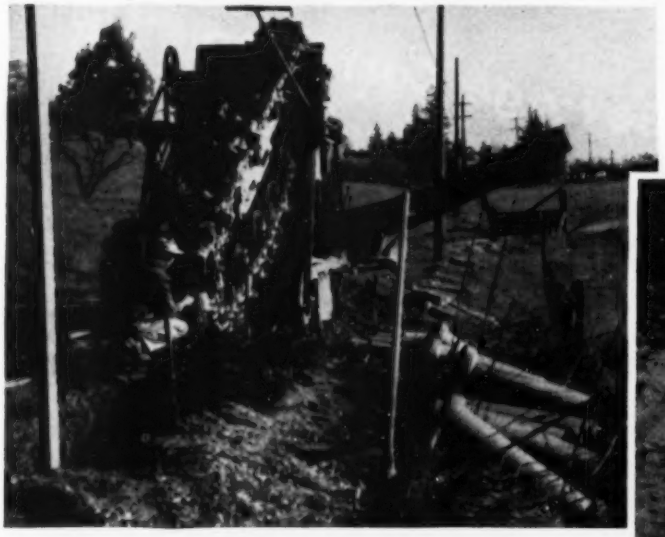
THE CHAPMAN VALVE MFG. CO.

INDIAN ORCHARD, MASSACHUSETTS

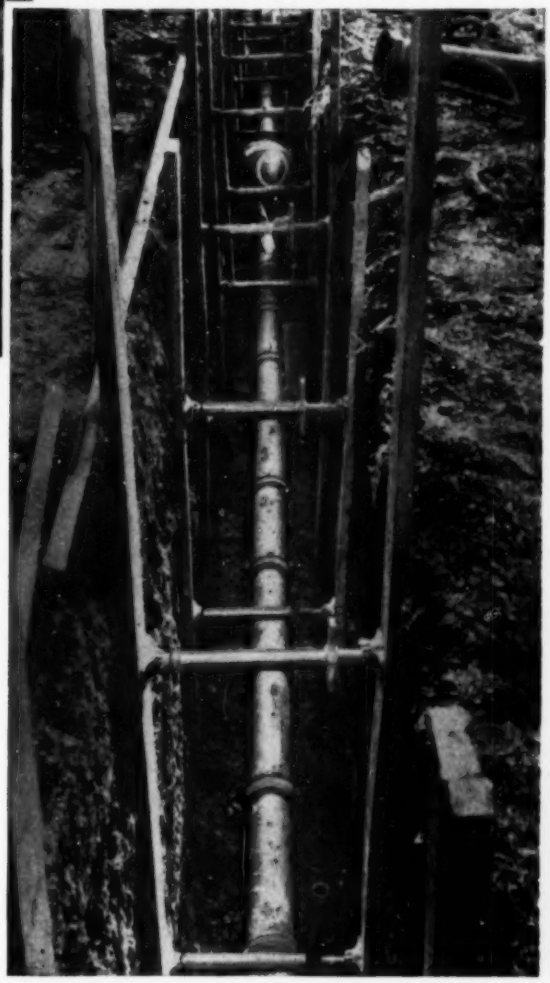


Cross-section of the Chapman Tilting-Disc Check Valve. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

CLAY PIPE—*ESSENTIAL* ★ *ECONOMICAL* ★ *EVERLASTING*



Clay Pipe—381,000 feet of it—was used in this sewerage project northeast of San Jose, California, a residential area that mushroomed as defense workers poured into the area.



CLAY PIPE gets another 72-Mile Testimonial

Here's a testimonial 381,000 feet long, proving once again that Vitrified Clay Pipe is the time-tested material engineers and public officials depend on for sanitary sewerage. Thanks to their foresight, thousands of new homes in the San Jose district, as well as essential housing projects throughout the nation, will enjoy the *permanent* sanitary protection that only clay pipe can offer.

Vitrified Clay Pipe assures generations of trouble-free service. Acid sewage or alkaline soils can't corrode it . . . time can't weaken it. It's the only chemically inert sewerage material — *the only pipe that never wears out!*

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Evansville, Ind. (Municipal Expansion)	200,000 ft.
Detroit, Mich. (Jet Engine Plant)	28,000 ft.
Topeka, Kan. (Private Housing)	13,000 ft.
Tucson, Ariz. (Municipal Expansion)	38,000 ft.
Minneapolis, Minn. (Private Housing)	80,000 ft.

Vitrified
CLAY
CLAY DUCT NEVER WEARS OUT!
PIPE

C-1252-59

YOU can stop costly sewage corrosion before it starts, increase the working life of your sewage treating tanks and equipment, and cut maintenance costs to a minimum when you protect with Pitt Chem Tar Base Coatings.

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

COMING ARTICLES

Miami in the LIME-light—and at a Profit ..... *Wertz*
Safety in Water Works—Your Problem and Mine ..... *LaDue*
Safety in Sewage Works and Sewer Maintenance ..... *VanKleeck*
Iron and Manganese Removal ..... *Nordell*
Rendering Plant Wastes and Their Treatment ..... *Farrell*
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Simplified Field Test for Iron in Waters ..... *Lieber*
A Guide to Preventive Maintenance for Sewage Works ..... *McDonald*
Corrosion Control at Cedar Rapids ..... *Cherry*
Water Works Practices (Short course type articles*) ..... *Symons*

*In this issue is the first, of a series of short-course articles on *"Sewage Works Practices"* by Prof. Don Bloodgood. Articles of these two series will appear in alternate issues.

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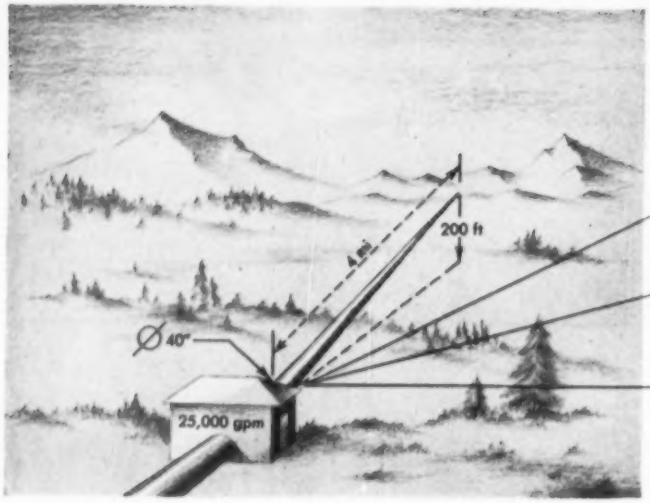


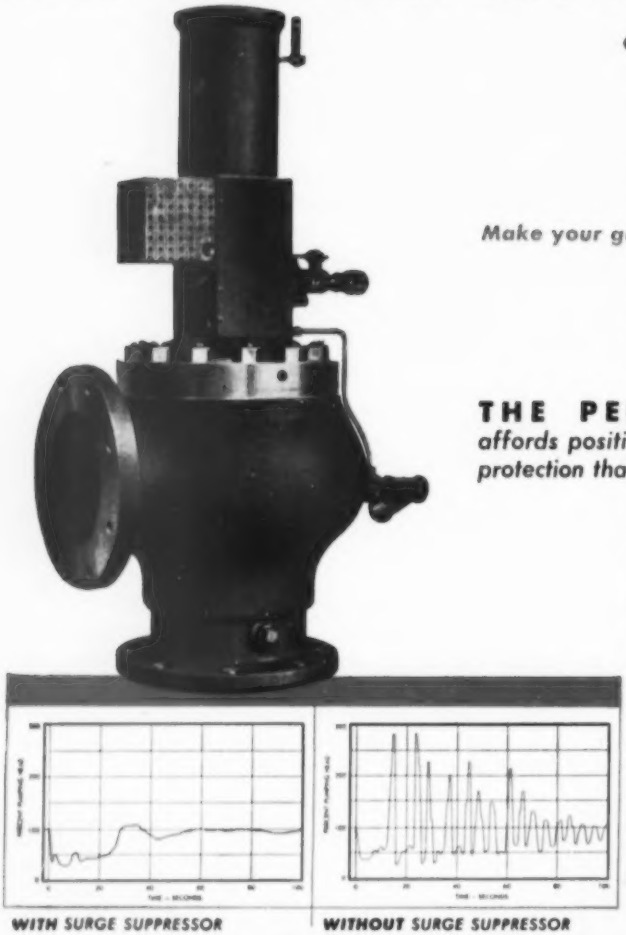
250 feet of head

525 feet of head

975 feet of head

?

CAN YOU PICK THE CORRECT ANSWER?



- **Here is the problem:** Estimate how high total pressure head could rise from surge if power failure brought the pump in this system to an abrupt stop.

  25,000 gallons per minute are being pumped up an elevation of 200 feet in a total pipeline length of 4 miles. Pumping head is 250 feet. Pipe diameter is 40 inches. A check valve is used to stop backflow through the pump.

Make your guess, then here is the answer

Total pressure head could rise as high as 975 feet. Inertia of the upward moving column of water builds up great potential energy. As the water settles back against the check valve, a succession of dangerous pressure waves occurs, often sufficient to burst the pipeline.

THE PELTON SURGE SUPPRESSOR

affords positive protection against this ever present danger — protection that no other valve gives.

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Lower pipeline costs can more than pay for a **PELTON** Surge Suppressor. Extra weight is eliminated because the pipe need not be designed with large safety factors in anticipation of high surge pressures. The possibility of line failures and interrupted service is greatly decreased.

Installations needing protection occur wherever water is pumped to a higher elevation either through a long pipeline or at high velocity. **PELTON** Surge Suppressors can be furnished to protect waterlines of any size handling service pressures up to 800 p.s.i.

Send us ***your*** *problem and include pipeline profile. Our engineers will make recommendations without obligation.*

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LARGE DIAMETER cast iron pipe, as illustrated, are efficiently serving as water, gas or sewer mains in large cities throughout the country. If this were a water supply line or an intercepting sewer, either bell-and-spigot or mechanical joint pipe might be used; however, for a gas feeder main these days it would most likely be mechanical joint.

Our pipe 30-inch and over, flexible joint and integral flange pipe are all made by the pit cast process. Pipe in sizes 2-inch through 24-inch are cast centrifugally in metal molds with bell-and-spigot, mechanical joint or plain ends. No matter whether pit cast or centrifugally cast, the quality of our pipe is scientifically controlled throughout its manufacture.

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FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

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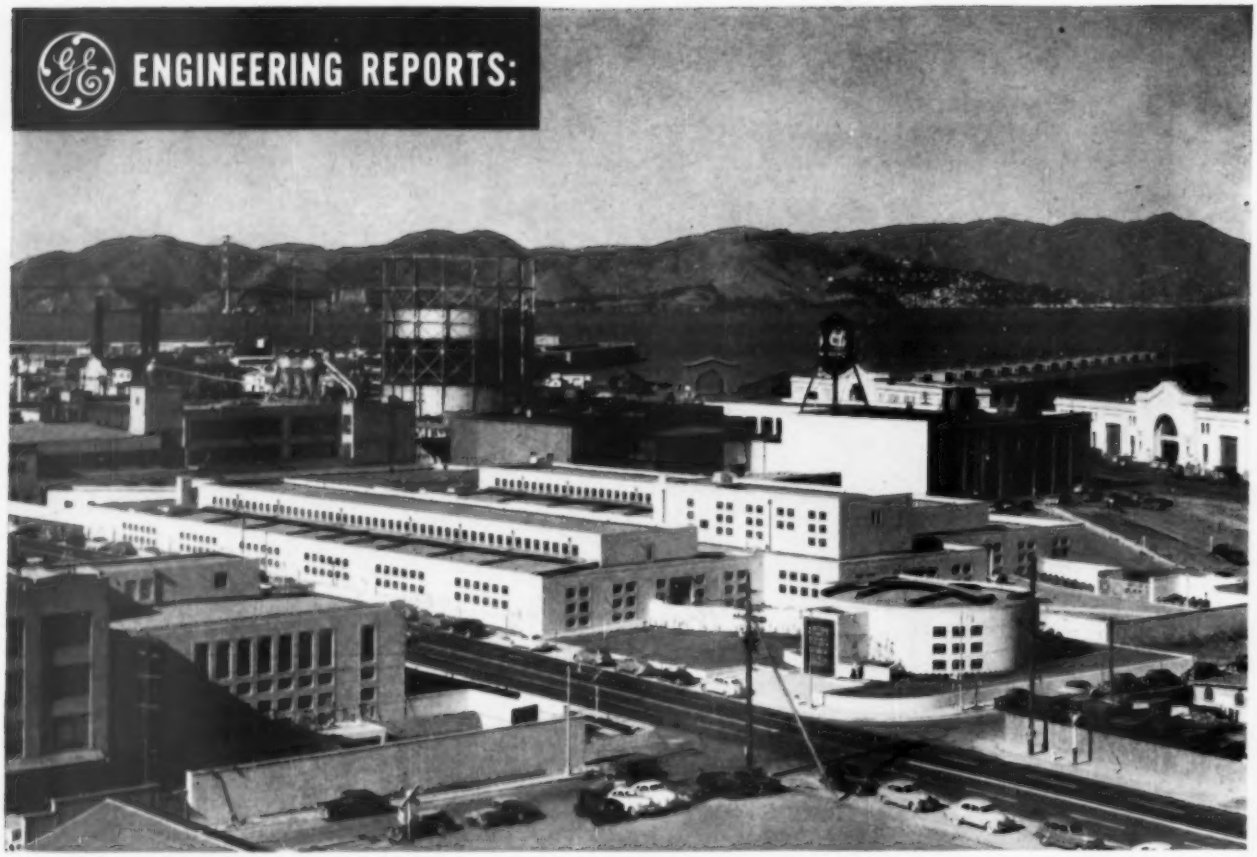
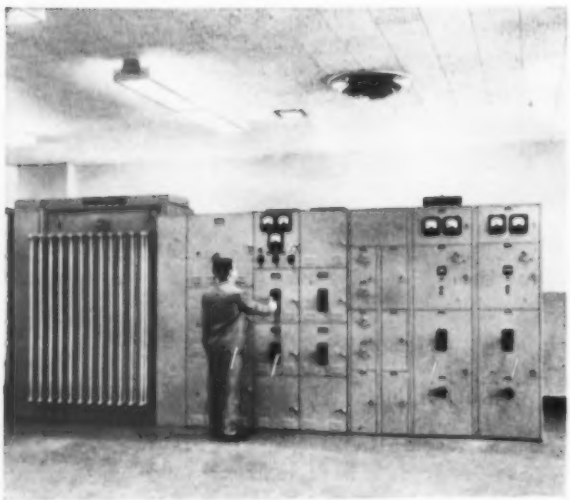


1 **COMPLETELY ENCLOSED OPERATION** at San Francisco's North Point plant represents a modern trend in treatment-plant design. Attractive appearance and air purification make such a plant a good neighbor in any industrial area. M. & K. Corp., Stolte, Inc., Fred J. Early, Inc., and Haas & Rothschild acted jointly as general contractors for the plant. Electrical contractors were Pacific Electrical and Mechanical Co., Inc. and Del Monte Electric Co.

San Francisco continues its

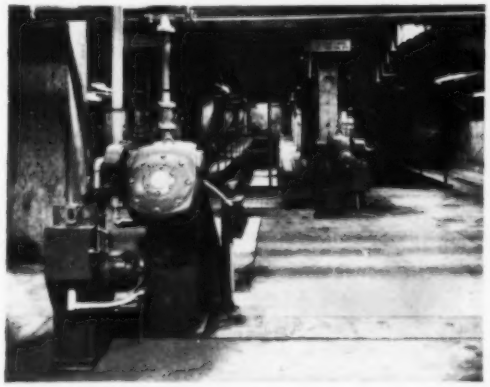


6 **RELIABLE AND ECONOMICAL** power distribution is provided by G-E load-center unit substation (with Cabinetrol), one of two which supply 480-volt power for small process motors.

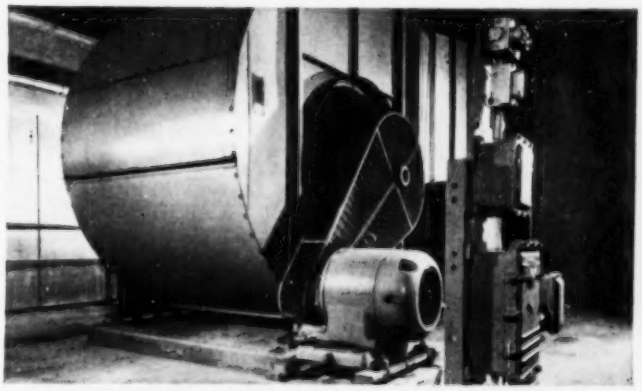
7 **MAIN CONTROL ROOM,** completely G-E equipped, houses line-up of main plant switchgear and limitamp control. Field rheostats and exciters for lift-pump motors are at left.

2 **CHLORINE CONTROL PANEL,** specially assembled by G.E., makes it easy to adjust output of plant's six chlorinators to match influent rate.

4 **SIX BLOWERS,** supplying all air for preaeration process, are each driven by a 40-hp G-E Tri-Clad* motor. G-E Cabinetrol* panel in background provides central control and protection of these motors.



3 **IN PRE-TREATMENT** and grit-removal building, small G-E totally enclosed motors drive sand collector and cross scraper, and grit-channel scraper.



5 **EXHAUST FANS,** driven by G-E totally-enclosed motors, are located in all buildings to prevent accumulation of nauseous and inflammable fumes. Air is treated with chlorophyll before discharge.

CLEAN WATERS program

New North Point treatment plant is major step in plan permitting development of waterfront recreation areas

Recent opening of San Francisco's new North Point Sewage Treatment Plant marks the completion of the largest single unit in a planned 21-plant pollution control system for the city. According to City Engineer Ralph G. Wadsworth, the new 150-mgd plant, in conjunction with others, will make possible the development of safe, attractive bathing and boating areas and will result in general improvement of the entire waterfront.

San Francisco chose efficient, long-life General Electric equipment for a large part of North Point's electrical system. In addition, G-E application engineers worked closely with city engineers to help design an electrical system exactly tailored to the requirements of the new plant.

Specialists in sewage-plant electrification, G-E application engineers are ready to work with *your* engineers or consultants, too. Backed by unexcelled engineering facilities, they'll help in designing a coordinated electrical system for your new plant or modernization project. Contact your local G-E Apparatus Sales Office early in the planning stage. General Electric Company, Schenectady 5, N. Y. 666-73

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is the REX® TOW-BRO way to improved sludge removal

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2. Greater Solids Concentration . . . Tow-Bro principle assures much higher solids concentration than is obtainable with conventional scraper-type mechanisms.

3. Low Cost . . . no sludge hopper or center pier required. Greater solids concentration means less tank volume, smaller piping, less pumping.

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5. Greater Operating Flexibility . . . varying rate of sludge draw-off over wide range as possible without diluting vortex action provides greater operating flexibility.

6. Easy Adaptation . . . Tow-Bro is easily adapted to round, square or rectangular tanks . . . new or existing.

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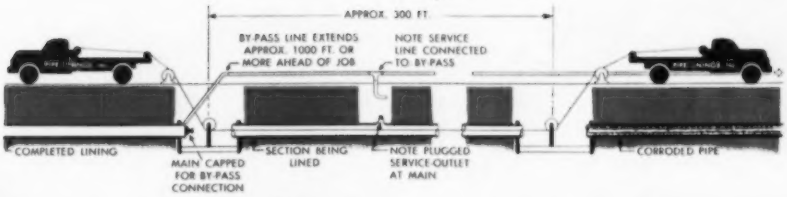
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BY-PASS LINE EXTENDS APPROX. 1000 FT. OR MORE AHEAD OF JOB
NOTE SERVICE LINE CONNECTED TO BY-PASS
COMPLETED LINING
MAIN CAPPED FOR BY-PASS CONNECTION
SECTION BEING LINED
NOTE PLUGGED SERVICE OUTLET AT MAIN
CORRODED PIPE

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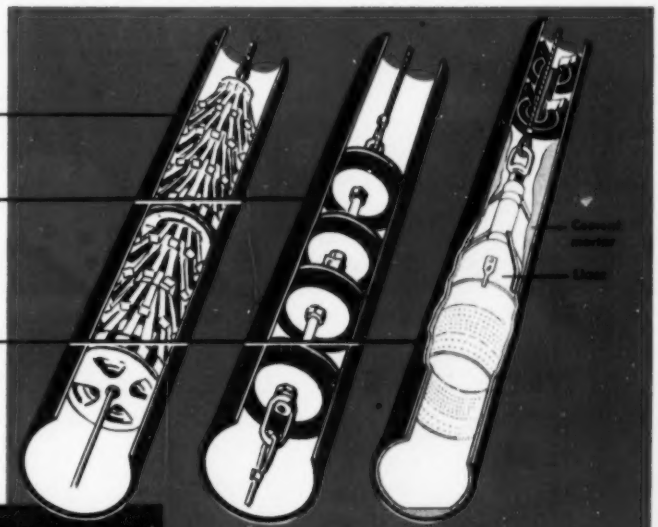

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The Tate Process makes it look like this!

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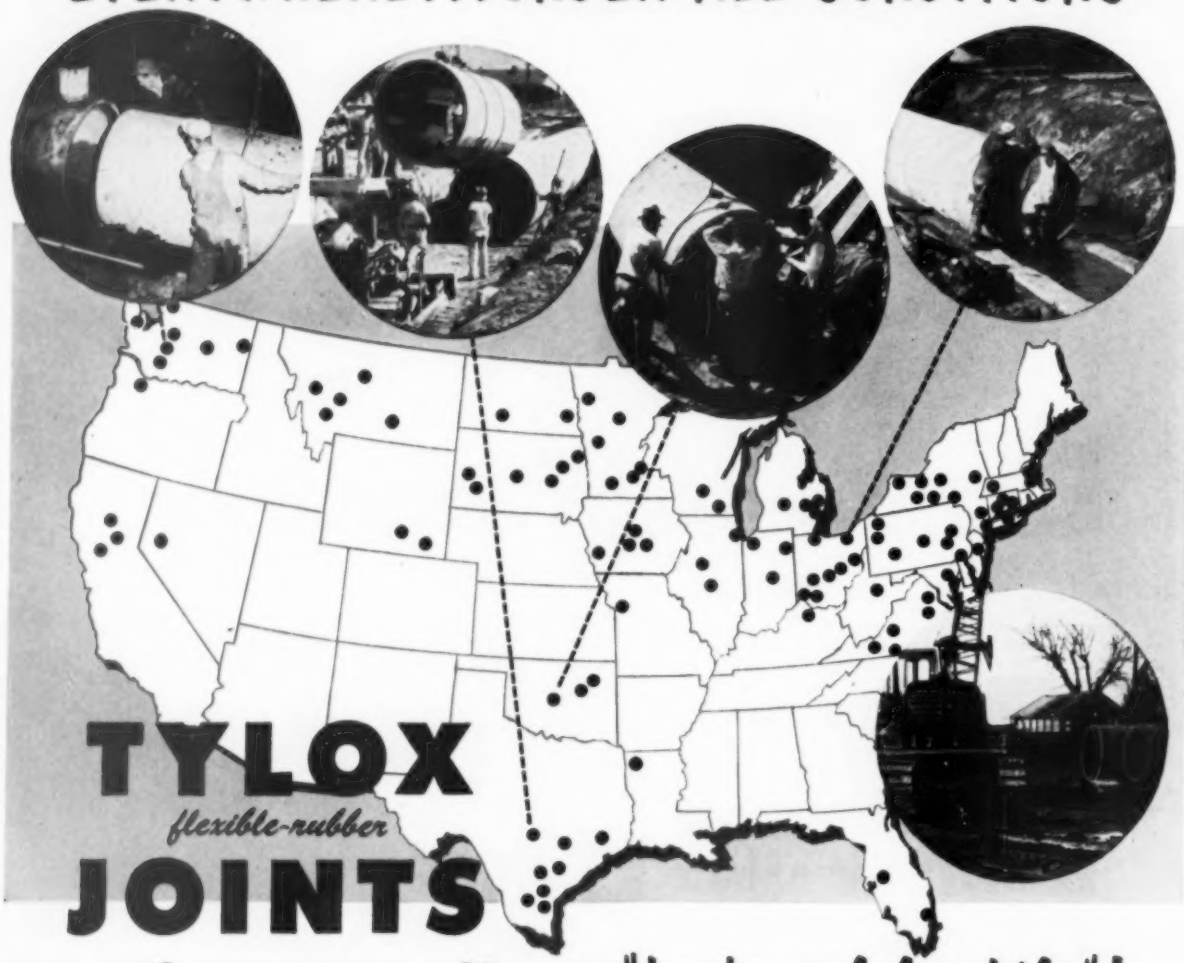

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The TYLOX JOINT is an all-rubber joint. It is flexible, resilient, chemically resistant, and long lasting. It is easily and quickly applied. It forms a "tight pack." It withstands hydrostatic pressure. It automatically compensates for angularity, soil stresses, and pipe expansion or contraction. It can be used on pipe laid in the wettest ditch or under the hottest sun. It requires no "setting" or "curing" time—permits immediate "back-filling" —gives lower "per laid foot" costs. And, most important, it provides a permanently tight joint that stops leakage or infiltration.

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Be sure of a tight line with the right coupling. Write, wire, or phone for specification data and literature on TYLOX GASKETS!

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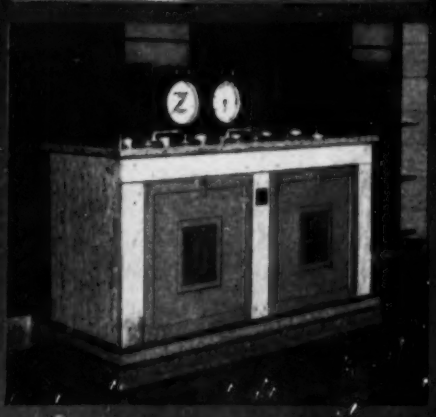

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INDICATING-RECORDING FILTER GAUGES
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The long life and low maintenance cost of cast iron water mains—and the consequent tax savings to the public—are matters of record. An ounce of *proof* is worth a pound of *claims!*

One of a number of cast iron water mains which have been in service in New York City for more than a century. Over 35 other cities have century-old cast iron mains in service.

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America's No. 1 Tax Saver

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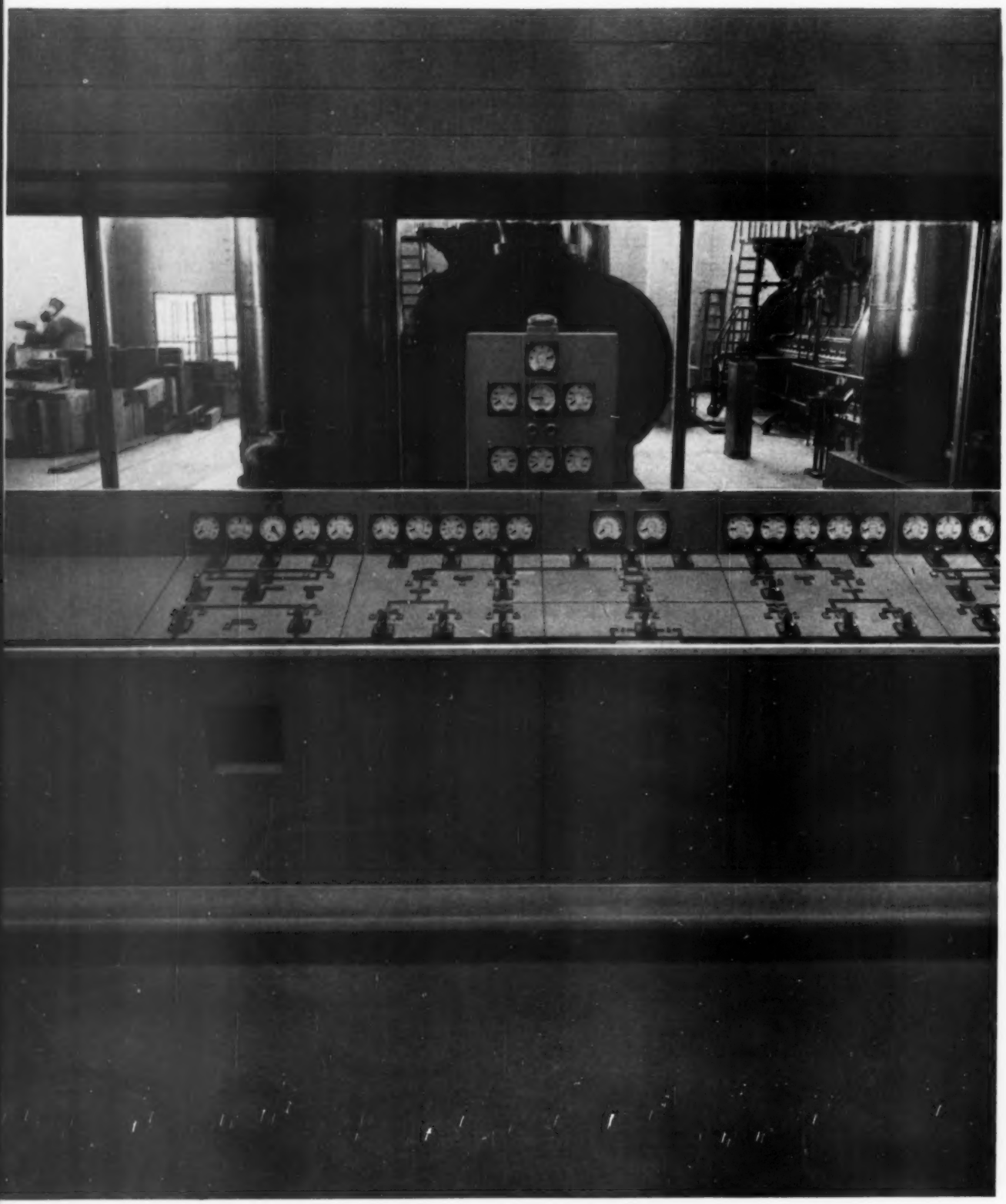
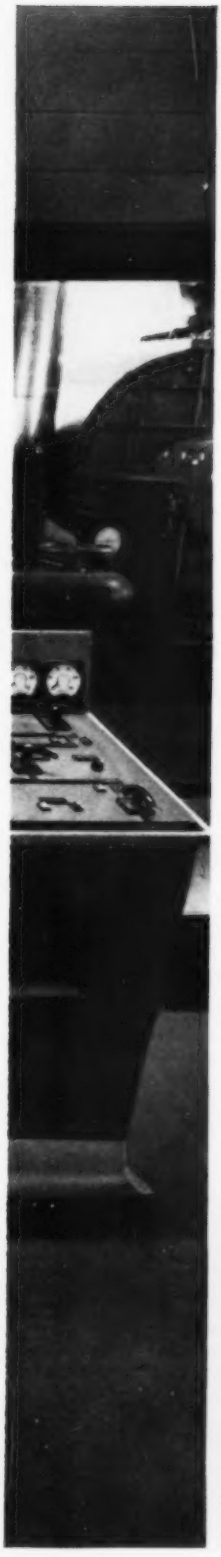


New Hunts Point Sewage Control Plant, Bronx, New York, has a design capacity of 120 million gallons per day (mgd). Future plant expansion will ultimately increase capacity to 150 mgd. J. Livingston & Co., New York City, electrical contractor.



Sound planning and unit equipment assure reliable power at Hunts Point

Service continuity is extremely important to the new 120-mgd Hunts Point Sewage Disposal Works—significant step in the City of New York's pollution control program. Shutdowns would affect a tributary population of 770,000 in a 15,613 acre area.

Based on a careful study during the blueprint stages, engineers for the Department of Public Works, City of New York, designed a duplex electrical distribution system. It assures reliable service by providing dual feeders, switching capacity and transformers, plus electrical tie breakers.

Supplementary power is available from two by-product gas engine generators—each rated 875 kva. These can also be operated as blower drive motors.

Westinghouse power, switching and control equipment play a vital part in the duplex system. Co-ordinated specifically for Hunts Point, this completely unitized line installed easily. It simplifies maintenance due to accessibility of breakers and controls. It assures easy, economical expansion because of its inherent flexibility.

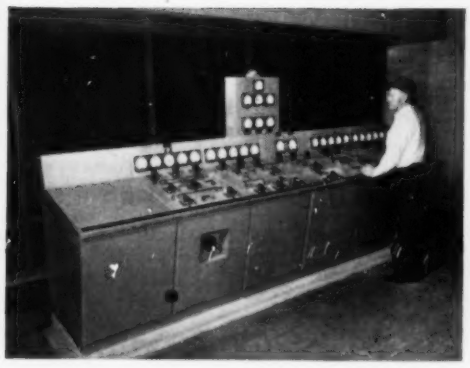
Hunts Point is another instance of Westinghouse participation in sewage control projects—ranging from special engineering assistance to supplying a complete line of electrical distribution equipment.

Call your nearest Westinghouse office for examples in your own area. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

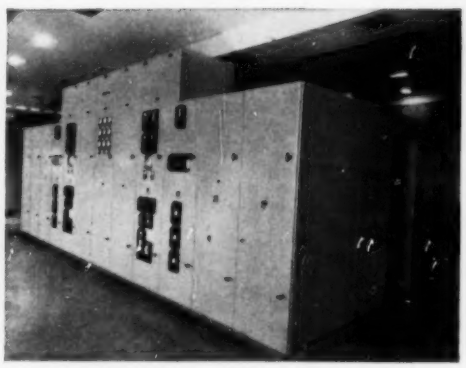
J-94962

YOU CAN BE SURE...IF IT'S

Westinghouse



Westinghouse Main Control Benchboard provides finger-tip control of virtually all plant operations. From it, utility and plant power can be controlled through remote switching of feeders and transformers in both systems.



Westinghouse Indoor Metal-Clad Switchgear, 4160 volts, is located back to back with similar switchgear which controls utility power supply. Factory assembled and tested, this compact unit installed easily and saved building space.

MUELLER

INSERTING VALVES AND EQUIPMENT

for inserting control valves where a shutdown is impractical

H-800 INSERTING VALVE

New smaller valve sleeve permits fast, easy installation in minimum space. Valve mechanism is the same as standard Mueller gate valve (repair parts interchangeable). Sizes 4", 6", and 8" (sizes of valves correspond to size of main).

DRILLING MACHINE

The C-C hand-operated or C-1 power-operated machine may be used for both drilling the main and inserting the valve plug. The C-1 machine may be operated either by the H-660 Air Motor or the new H-602 Gasoline Engine Drive Unit.

This new portable unit may be used to power the C-1 drilling machine. Compact and easily handled, this power unit can be used on many jobs. Its' ten-foot flexible drive shaft allows unrestricted movement. Remote control throttle permits full control of power at drilling machine.

H-810 BASIC INSERTING EQUIPMENT

An assembly of pressure confining units plus a slide valve. Permits the drilling of the main and inserting of the valve plug, easily and safely, with no water loss.

H-602 GASOLINE ENGINE DRIVE UNIT

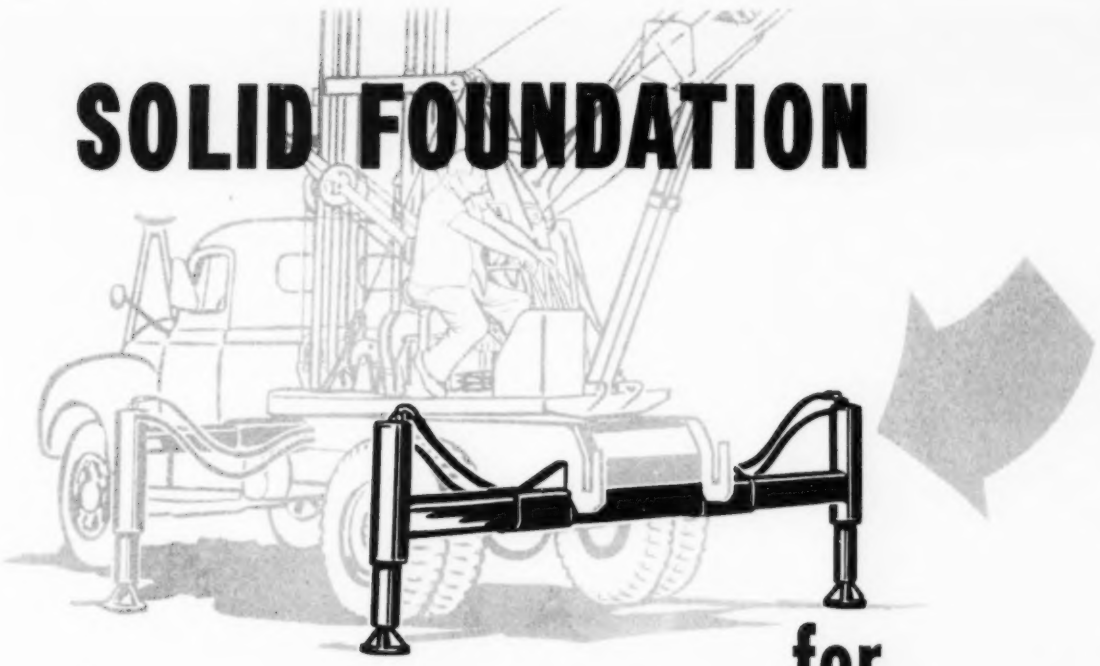
Write for Catalog H-20 and H-602. Complete illustrated instruction manuals and parts list shipped with equipment.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

SOLID FOUNDATION



for Real Crane STABILITY

The all-hydraulic, 3-ton Bucyrus-Erie Hydrocrane has its feet on the ground — solidly. Four husky outriggers set and retract hydraulically in seconds — through controls at the operator's station. Independent control of each outrigger makes it possible to level crane quickly on bumpy ground — without cribbing or blocking.

Heavy loads can be inched into place smoothly, safely — no danger of bouncing and swaying due to flexing of tires and truck springs. Outriggers are an integral part of the crane sub-base, eliminating wracking, twisting strains to chassis and heavy pressures on truck tires. With outriggers taking the load, excess weight can be eliminated for speedier crane operation, easier truck handling, lower operating costs. And, with these outriggers the Hydrocrane has four times lifting capacity of a conventional crane of the same size.

Here's another advantage. If the truck gets stuck, you can jack it up with the outriggers — and it's easy to change a tire.

Extra stability is just one of many reasons why water and sewage department users are sold on the Hydrocrane. Send the coupon for full details or see your Hydrocrane distributor.

The combination of outriggers for solid stability and hydraulically telescoping boom for extra reach make the Hydrocrane ideal for laying water and sewer mains . . . setting valves and hydrants . . . loading and unloading supplies.

SOUTH MILWAUKEE BUCYRUS ERIE HYDROCRANE WISCONSIN

☐ Please send Hydrocrane literature.
☐ I am interested in a demonstration.

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COMPANY.....
ADDRESS.....
CITY..... STATE.....

163H52

BUCYRUS-ERIE HYDROCRANE DIV.

South Milwaukee, Wisconsin

Two Eimco Vacuum Filters and dried sludge conveyor installed in Waterbury, Conn., Sewage Plant. Construction directed by City Engineer Henry C. Whitlock, supervised by Sanitary Engineer and Plant Superintendent Walter M. Kunsch.

NEW SEWAGE PLANT DEWATERS SLUDGE

—and **Everdur** is chosen for the Eimco Vacuum Filters that do the job

When Malcolm Pirnie, consulting engineer of New York, designed the new sewage treatment plant for Waterbury, Conn., he took into consideration the nature of the influent which was domestic sewage mixed with industrial wastes. Vacuum filtration and incineration were advised.

Eimco Corporation, of Salt Lake City, Utah, supplied the two vacuum filters. They are of the continuous rotary type, equipped with a standard swing agitator. Eimco had to consider the effect of the varying agents of corrosion in the raw sewage upon the metal components of these filters. Everdur* (ANACONDA Copper Silicon Alloys) was a logical choice to resist the corrosive action of the sludge effluent. In the Eimco filters all woven wire screens (5 x 5 mesh x .063" gage), division strips, bolts, nails and screws were made of Everdur.

Great strength, high corrosion resistance, good working and welding properties have recommended the use of Everdur as a reliable, durable alloy in sewage and waterwork installations for a quarter century. In handling industrial wastes, corrosion problems are particularly complicated. For the proper Everdur Alloy, we suggest that you take advantage of the services of our Technical Department. Write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

★ ★ ★

EVERDUR *is ideal for wrought assemblies such as gates, screens, float chambers, weirs, troughs, manhole steps, gate guides, stems and bolts.*

32153

*Reg. U. S. Pat. Off.

specify **EVERDUR**— **ANACONDA**® **COPPER SILICON ALLOYS**

Strong—
Weldable—
Workable—
Corrosion-Resistant—

for Municipal Water Storage

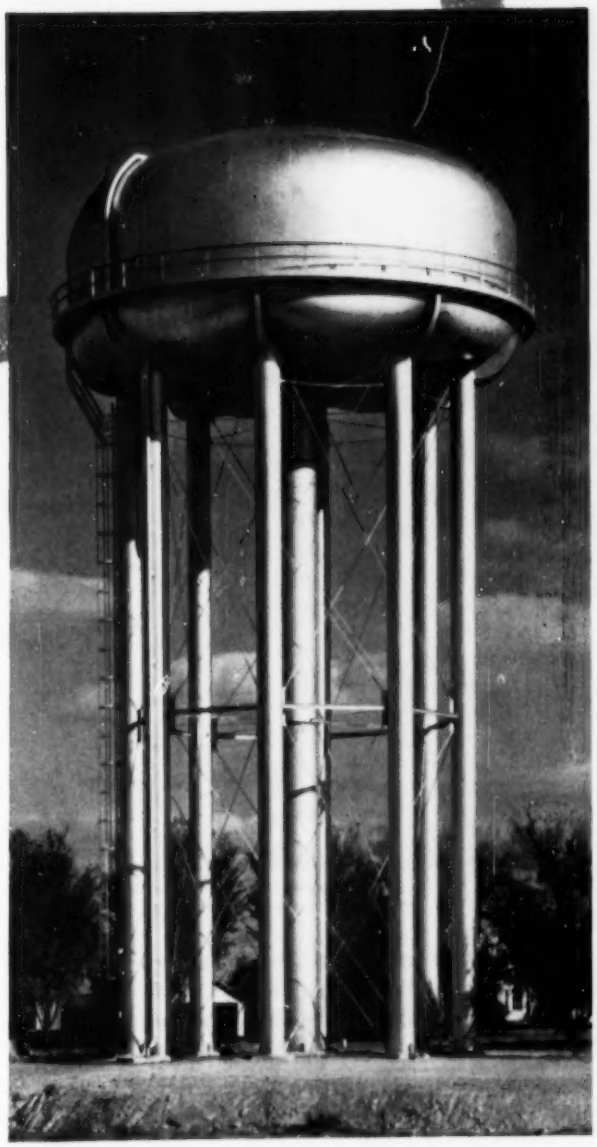
in America's Dairyland

The City of Appleton, Wisconsin, installed a 500,000-gallon Horton elevated tank in 1950 to help maintain pressure in its water distribution system. Appleton, in the region known as America's Dairyland, covers 8¼ sq. mi. and has a population of 35,000.

Water for the Appleton system is taken from the Fox river which flows through the southeast section of the city. The new elevated tank is located on the north side of the city at the greatest possible distance from the pumping station and helps reduce pressure variations throughout the system. A previously erected 500,000-gallon Horton elevated tank is located in the downtown area not far from the pumping station.

The system serves 8,501 domestic users, 725 commercial and industrial customers and 794 fire hydrants. Total consumption ranges from 3,200,000 gpd to 7,500,000 gpd and averages 4,135,000 gpd.

Horton elevated tanks for municipal water storage are built in standard capacities from 15,000 to 500,000 gallons with ellipsoidal bottoms—from 500,000 to 3,000,000 gallons with radial-cone bottoms. For more information please contact our nearest office. There is no obligation on your part.



500,000-gal. Horton elevated steel tank with radial-cone bottom at Appleton, Wisconsin

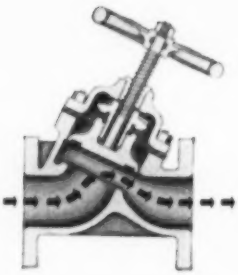
HORTON

WELDED STEEL STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

Atlanta 3	2181 Healey Bldg.	Houston 2	2115 C. & I. Life Bldg.
Birmingham 1	1586 North Fiftieth St.	Los Angeles 14	1555 General Petroleum Bldg.
Boston 10	1018—201 Devonshire St.	New York 6	3390—165 Broadway Bldg.
Chicago 4	2198 McCormick Bldg.	Philadelphia 3	1644—1700 Walnut Street Bldg.
Cleveland 15	2262 Midland Bldg.	San Francisco 4	1583—200 Bush St.
Detroit 26	1551 Lafayette Bldg.	Seattle 1	1350 Henry Bldg.
Havana	402 Abreu Bldg.	Tulsa 3	1646 Hunt Bldg.



FOR SAFER CONTROL ---------- OF HARD-TO-HANDLE FLUIDS

CRANE Packless Diaphragm Valves

Now Available in New Materials

WORKING PRESSURES — up to 150 pounds. Water, air, oil, or gas, 180° F. maximum temperature, depending on valve size and materials.

You asked for it—and now Crane gives you this outstanding Diaphragm Valve in a new wide choice of body, disc insert, and diaphragm materials—in unlined or lined patterns. Whichever is specified, Crane design gives you important advantages including—long diaphragm life . . . positive shut-off in case of diaphragm failure . . . less resistance to flow with minimum pressure drop . . . easy operation . . . simplified maintenance at lowest upkeep cost.

Full specification data is in your new Crane 53 Catalog—or ask your Crane Representative.

SCREWED ENDS, UNLINED Sizes ½ to 2 in.
Brass, Cast Iron, Aluminum, or 18-8 Mo body and disc. Furnished with neoprene, Buna N, and natural rubber diaphragm and disc insert.

FLANGED ENDS, UNLINED Sizes ½ to 6 in.
Cast Iron, Aluminum, or 18-8 Mo body and disc. Furnished with neoprene, Buna N, and natural rubber diaphragm and disc insert.

FLANGED ENDS, LINED Sizes 1 to 6 in.
Cast Iron body only. Lined with neoprene or hard natural rubber. Disc coated with neoprene or soft natural rubber.

•

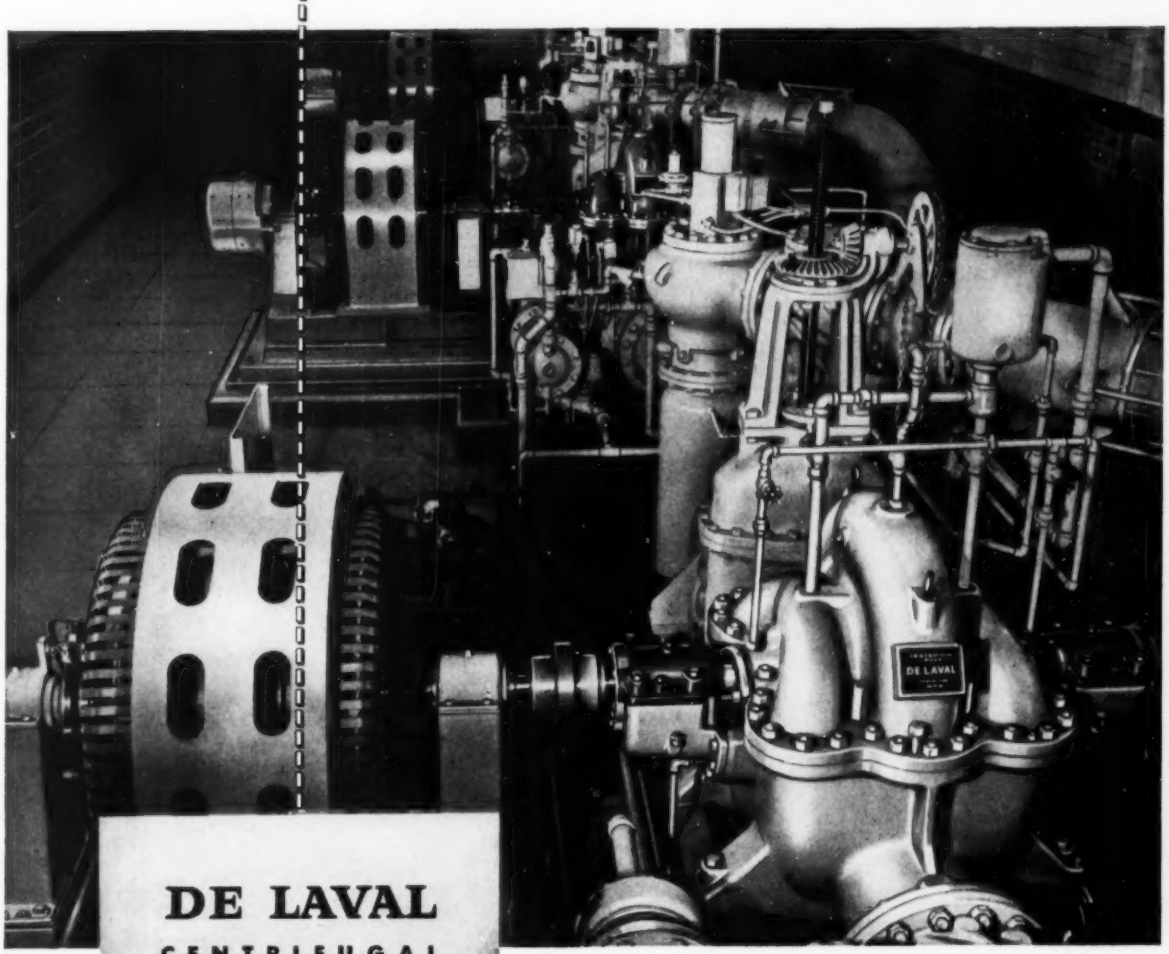
Other body and disc materials, as well as linings, available on special order. Also sliding stem valves for automatic operators of all types.

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

A new threesome for Cambridge



These three motor-driven De Laval centrifugal pumps were recently installed in the Fresh Pond water works of Cambridge, Mass. With an individual capacity of 12 mgd, 175 ft. total head and an efficiency of 88%, this trio will help bring many more millions of gallons of water to the homes and industry of this expanding New England community.

Since the turn of the century, De Laval water works pumps have been serving big cities and small towns throughout the country. These highly efficient De Laval centrifugal pumps are available in capacities ranging from less than 1 mgd to more than 100 mgd.

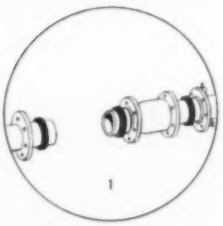
DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY
824 Nottingham Way, Trenton 2, New Jersey

If you have to install a valve in a hurry--with an eye toward economy....

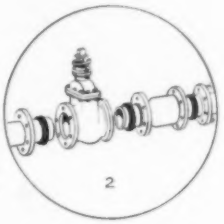
...specify **EDDY**

Cutting-in Valves and Sleeves



After excavation and removal of section of pipe, glands and gaskets are placed on pipe and sleeve. The sleeve is then pushed into position.

1



Valve is placed between pipe-end and sleeve, and pushed home against pipe. Sleeve is seated into bell of valve.

2

Glands, gaskets, bolts and nuts are then assembled at the 3 joints and tightened, using a ratchet wrench only.

3

Since 1849 EDDY For Long Service

EDDY

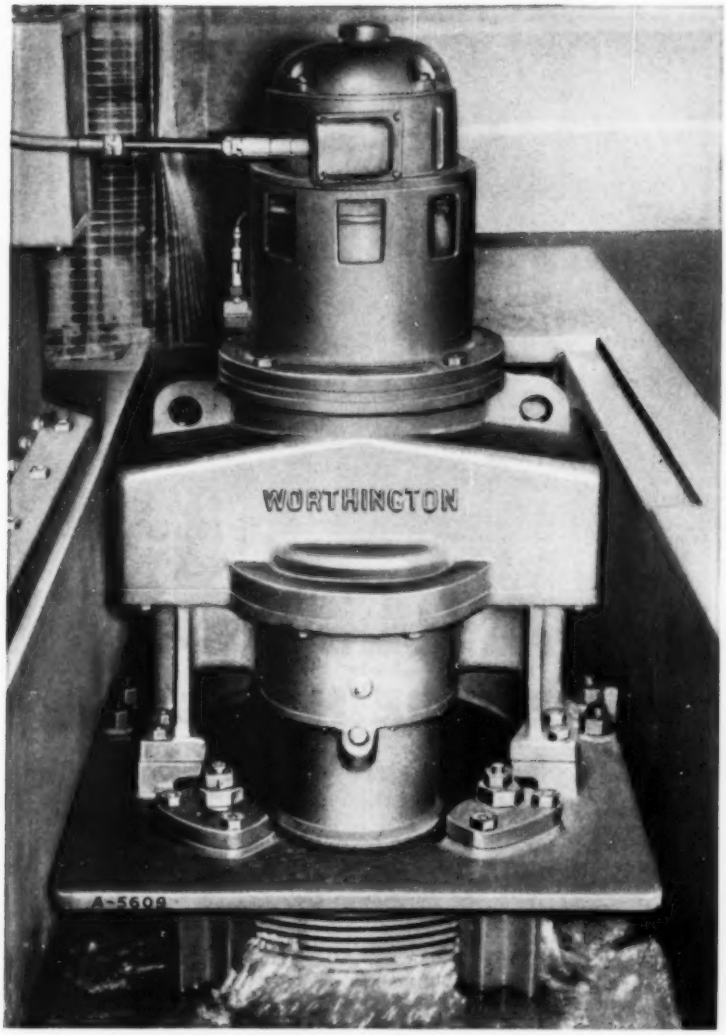
VALVE COMPANY

A Subsidiary of James B. Clow & Sons

WATERFORD, NEW YORK

Starting with step "1" above, two men with a ratchet wrench can install an Eddy Mechanical Joint Cutting-in Valve and Sleeve on an existing pipeline in less than 25 minutes. Every joint is bottle-tight under pressure, without caulking or lead-melting. Thus, the work can be done in any kind of weather, or in a flooded trench. Valves meet AWWA specifications; are available in 3 to 12" sizes for sand-cast and centrifugally-cast iron water pipe. Stock up now, for speedy installations.

Worthington comminutor replaces mechanically raked screen at Camp Kilmer



WORTHINGTON 25C6 COMMINUTOR installed in existing 3 ft. wide by-pass channel at Camp Kilmer, N. J. The average daily flow is 3.5 million gallons. Maximum daily flow is 7 million gallons. Sanitary Engineer is C. J. Shepherd.

Comminutor installed in existing channel in five hours

During recent improvements in the sewage treatment plant at Camp Kilmer, New Jersey, a Worthington 25C6 comminutor was installed in an existing by-pass channel.

The comminutor, set up and operating in five hours, replaced a bulky, mechanically raked screen which required separate handling and disposal of sewage solids.

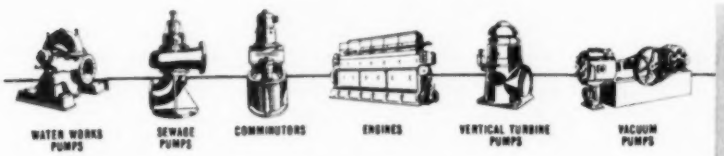
Refuse and sewage solids are now treated by a compact screening and comminuting mechanism which eliminates the health hazard caused by separate handling of solids.

Engineers everywhere recommend the completely automatic Worthington comminutor because:

- It can be readily installed in new or existing straight-flow rectangular channels.
- Cutter-racks are quickly removable for sharpening or replacement.
- It may be flooded without damage because of mercury-seal protection.

Let us work with you on your community's screening problem—or any other engineering problems involving sewage, water works, or municipal power generation. Write to Worthington Corporation, Public Works Division, Harrison, N. J.

W.2.6



All Major Public Works Equipment Under One Responsibility

WORTHINGTON

Public Works Equipment

Smoothest operating and best by far

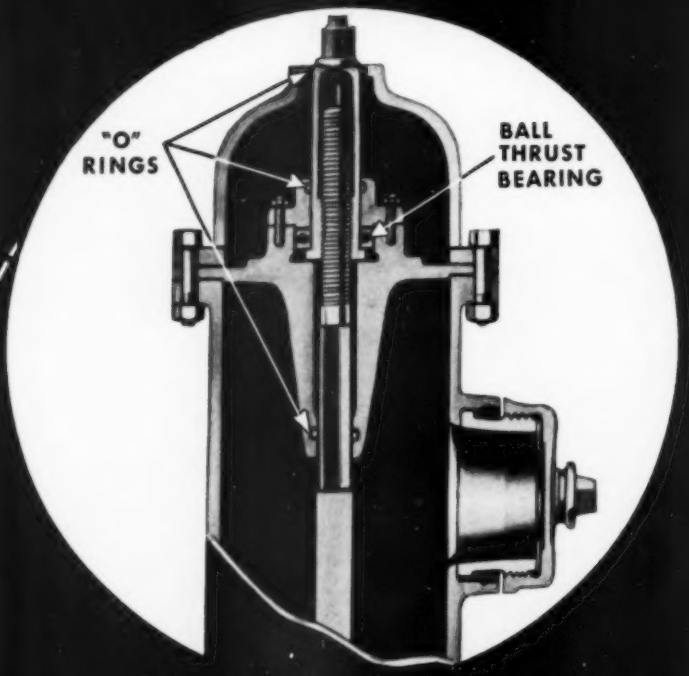


Photo above shows modern, clean-cut design of new Darling B-50-B fire hydrant. As in any Darling hydrant all inside working parts, including main valve and drain valve parts, can be removed through the top for easy inspection and simplified maintenance.

DARLING
B-50-B FIRE HYDRANT

THE Darling B-50-B fire hydrant, rated a major advance in hydrant design, eliminates the very things that often lead to unexpected trouble and failure in hydrant operation.

Note that it is *ball bearing* operated, for the smoothest, *surest* action ever! Opening and closing actually takes less than half the usual wrench torque!

Note, also, how the B-50-B design uses "O" ring seals, dispensing with the usual stuffing box, and resulting in a *dry top* hydrant! Moreover, these "O" ring seals not only prevent the loss of thread and bearing lubricant, but never let a drop of water reach the operating threads.

In short, the revolutionary B-50-B not only does away with much bothersome servicing such as gland adjustment, lubrication and packing replacement, but assures fast, easy operation when you need it most!

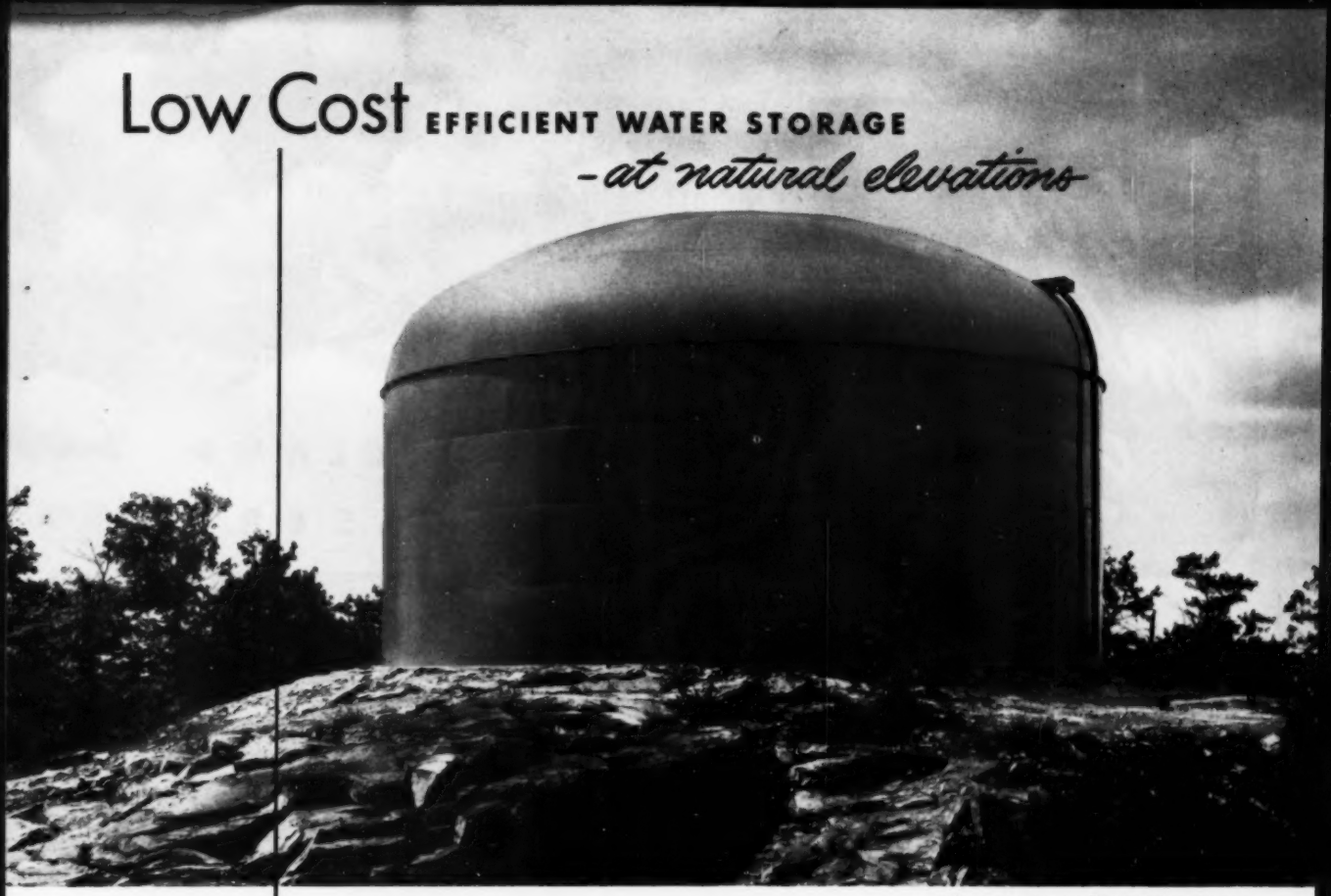
Before you decide on *any* hydrant, be sure to weigh *all* the advantages of Darling's B-50-B hydrant.

Send for Bulletin No. 5007

DARLING VALVE & MANUFACTURING CO.

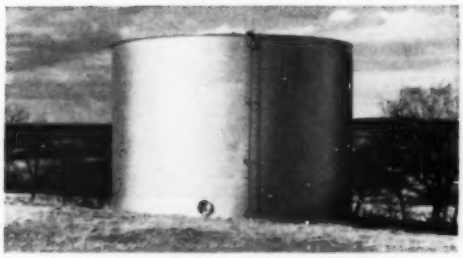
Williamsport 11, Pa.

Low Cost EFFICIENT WATER STORAGE
-at natural elevations



Worcester, Mass.—Ellipsoidal roof type, 1,500,000 gallons capacity.

* *Steel Reservoirs*



Liberty, N.Y.—Flat roof type, 300,000 gallons capacity.

St. Paul, Minn.—Ellipsoidal roof type, 2,000,000 gallons capacity.

by PITTSBURGH • DES MOINES

The advantages of strength, simplicity, and economy of construction make Pittsburgh-Des Moines Steel Reservoirs your outstanding choice for water storage where elevated sites are available.

Durable for a lifetime, guaranteed in design, workmanship and material, P-DM Steel Reservoirs are built in flat-, dome-, or ellipsoidal-roof types, unornamented, or with pilasters and other architectural features as specified. *Write for our latest descriptive Steel Reservoir Bulletin.*

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

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CHICAGO (3), 1222 First National Bank Bldg.	SEATTLE . . . . . 526 Lane Street
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You only dig once

WHEN YOU CLAMP WITH DRESSERS

Why pay for digging the same hole twice? Repeated repairs to leaking cast iron bell and spigot joints waste money. When you clamp with a Dresser Style 60 Bell-Joint Clamp, you fix it once and it's fixed for good.

The leak is effectively and permanently repaired.

Both the bell and the spigot ring of the Style 60 are adjustable to permit *exact* fit, even on offsize and foreign pipe. This positive adjustment to spigot and bell diameters assures the uniform sealing pressures required for a complete, lasting repair.

The Dresser Clamp also provides a *flexible* repair to protect against leaks should movement occur in the joint. The generous-size gasket extends well up the face of the bell to provide a suitable factor of safety.

Style 60's are ruggedly built for permanence. Millions are in use. Virtually every city in the country has discovered that it pays to "Fix it Once, Fix it for Good" with Dresser Style 60 Bell-Joint Clamps. Complete size range—3″ through 60″. Send your order today.

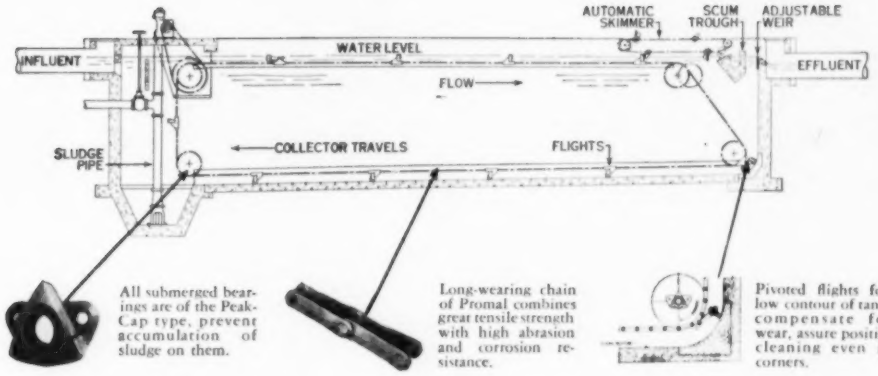
DRESSER
BELL-JOINT CLAMPS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, Calif.—Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide St., W., Toronto.

LINK-BELT Straightline Sludge Collectors help treat

2 BILLION GALLONS

of sewage per day


AUTOMATIC SKIMMER
SCUM TROUGH
ADJUSTABLE WEIR
INFLUENT
WATER LEVEL
EFFLUENT
FLOW
SLUDGE PIPE
COLLECTOR TRAVELS
FLIGHTS
All submerged bearings are of the Peak-Cap type, prevent accumulation of sludge on them.
Long-wearing chain of Promal combines great tensile strength with high abrasion and corrosion resistance.
Pivoted flights follow contour of tank, compensate for wear, assure positive cleaning even in corners.

Easy, economical sludge removal provided for water and industrial waste treatment plants

Since the first Straightline Sludge Collector went into service at Gastonia, N. C., in 1921, the great majority of the country's rectangular settling tanks have been equipped with this Link-Belt design. Straightline action provides the shortest possible travel of collected material at slow, uniform speed. Result: minimum disturbance of flow and maximum efficiency. In addition, they have a proven record for uninterrupted operation with minimum attention.

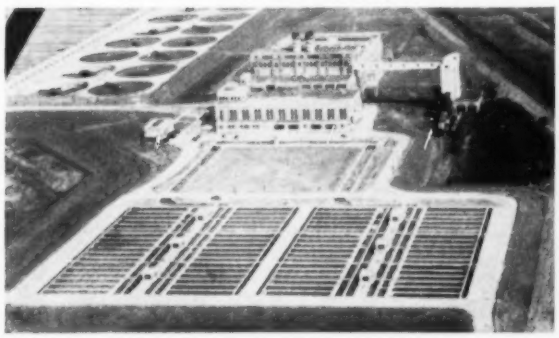
Straightline Collectors are part of the complete Link-Belt line of quality equipment. Our sanitary engineers will be glad to work with your engineers, chemists and consultants—help you get the best in modern water, sewage or industrial liquids treatment equipment.

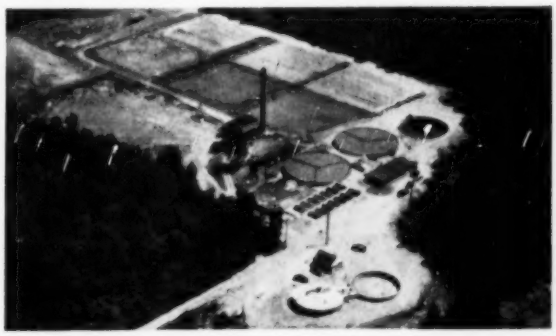
LINK-BELT

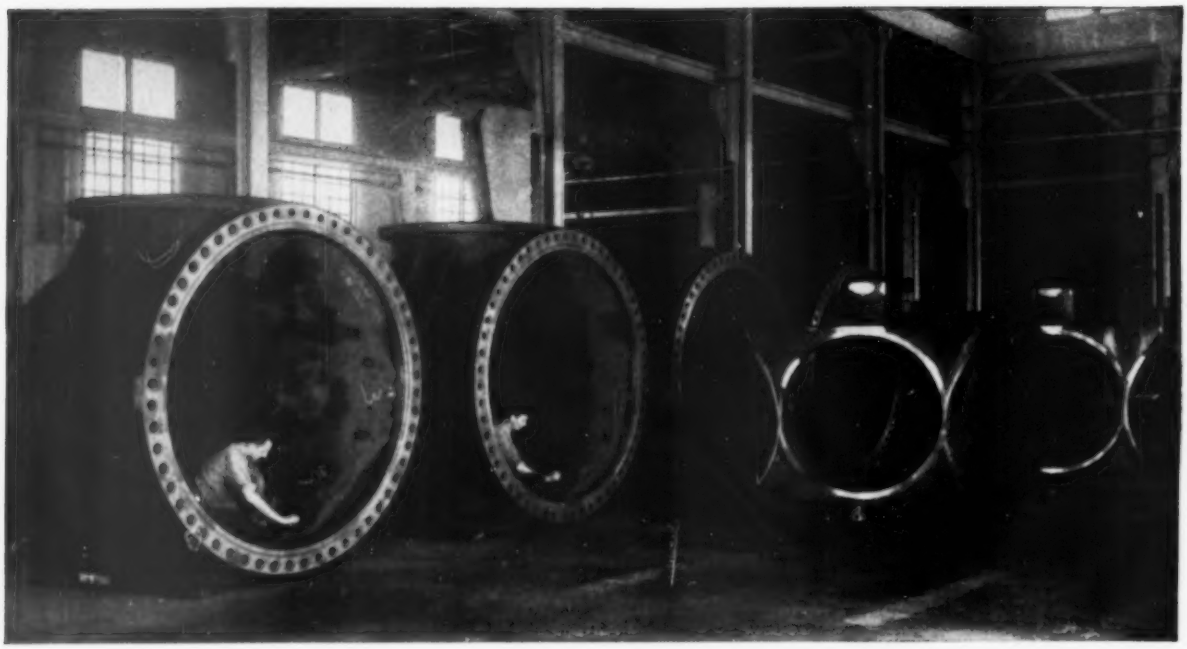
SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 12,972

Straightline Collectors, for both primary and final settling tanks, equip plants from 80,000 up to 600,000,000 gpd. Shown here: a 600,000,000 gpd plant (left) and 6,000,000 gpd (right).







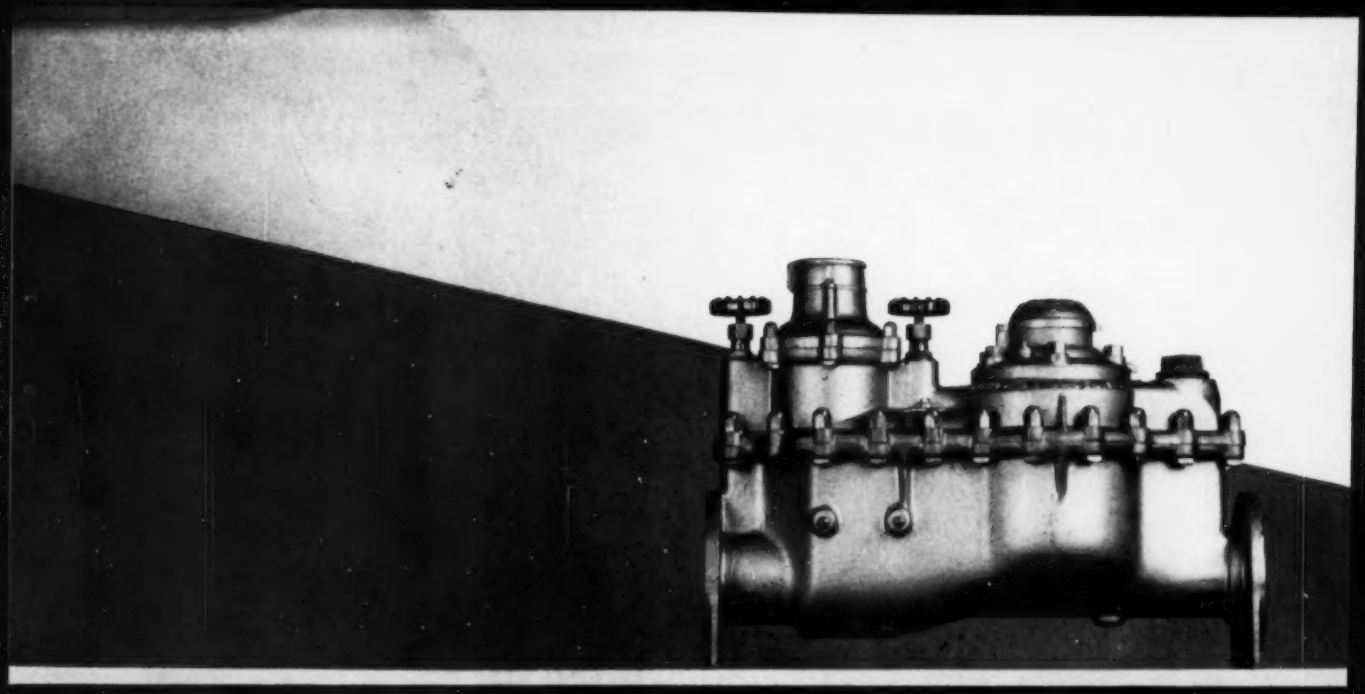
View of four bodies of 54" ROTOVALVES with two plugs in the background. These valves are part of a large order under construction for the City of New York, Board of Water Supply, Delaware Aqueduct Project.

A Very Real Contribution to Water Works Development!

The ROTOVALVE answers the ever increasing need in the waterworks field for a valve which couples ease of operation with positive performance under both normal and emergency conditions. For these reasons it was selected for both shut-off and throttling services on this important project.

S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.



HERSEY

HERSEY COMPOUND METERS

will accurately measure a wider range of flows than any other single unit or assembly of meters.

A Hersey Creation that has never been equaled

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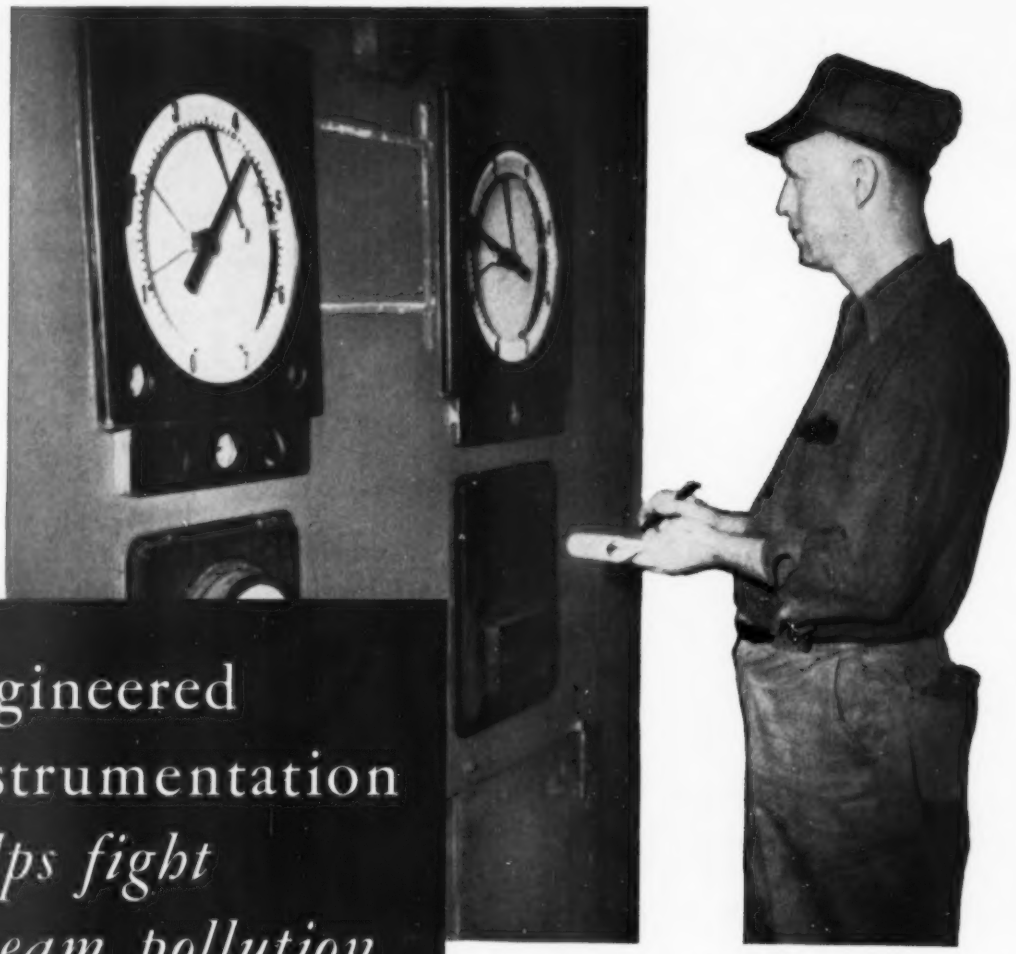


engineered instrumentation *helps fight stream pollution*

pH and Redox control by ***ElectroniK*** instruments assure thorough neutralization and reduction of waste liquor in a large electroplating plant.

YOUR plant's part in the "clean streams" program brings up an engineering problem—the treatment of industrial wastes and sewage. And it can be worked out most effectively through the use of soundly engineered methods of measurement and control.

You can count on Honeywell for the right instrumentation—applied the right way for your installation. You'll benefit by the extensive experience that Honeywell has gained through close cooperation *with consulting engineers* and plant technicians, on all types of treatment problems. At your disposal is a complete line of instruments for filtration, chlorination, aeration, drying, flotation, incineration and other specific processes—literally everything your treatment plant needs for automatic, centralized control.

Our local engineering representative will welcome the opportunity to discuss instrumentation with you and your consulting engineer. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4575 Wayne Ave., Philadelphia 44, Pa.

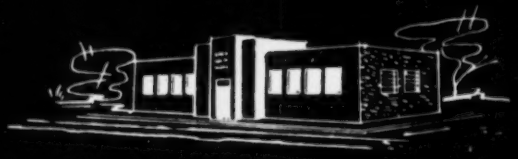
● REFERENCE DATA: Write for new Bulletin 1550—"pH and Conductivity Recorders and Controllers," and for new Bulletin 7302—"Water and Sewage Instrumentation."

MINNEAPOLIS **Honeywell**

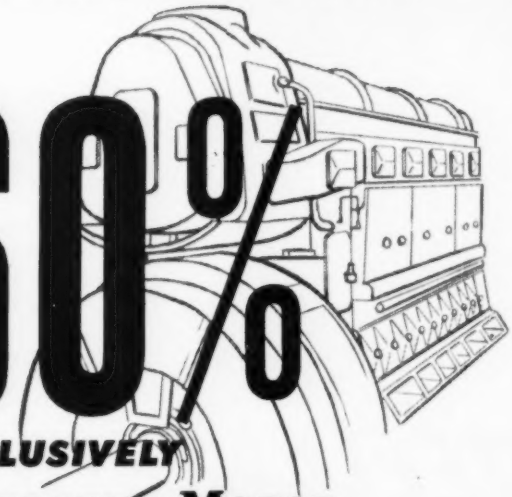
BROWN INSTRUMENTS

First in Controls

CITY-OWNED ELECTRIC GENERATING PLANTS



IN THE STATE OF MINNESOTA



60%

EXCLUSIVELY

FAIRBANKS-MORSE

60% . . . of the city-owned diesel power plants in Minnesota are *exclusively* powered by Fairbanks-Morse engines!

Add all other plants where F-M engines are used and the total becomes 76%.

Operating on diesel oil, natural gas or crude oil, these Fairbanks-Morse engines are generating over 53% of the total KVA capacity—and are producing important savings.

In Minnesota—or your state—*facts* establish the superiority of Fairbanks-Morse diesel and dual fuel engine performance. Their dependability, economy and low maintenance assure the best in power generation service—at a profit. Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • RAIL CARS • ELECTRICAL MACHINERY
PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY• MAGNETOS

CARLON PLASTIC PIPE BREAKS INSTALLATION TIME RECORDS
CARLON PIPE NOW USED FOR WATER SERVICE LINES
New CARLON Lightweight Plastic Pipe is Easier to Install and Lasts Longer
CARLON GUARANTEED AGAINST ROT, RUST AND ELECTROLYTIC ACTION
CARLON ACCLAIMED NEW PIPING ACHIEVEMENT
Stresses Need of Low-Cost
Public Housing

GUARANTEED FOREVER...

... AGAINST ROT, RUST AND ELECTROLYTIC CORROSION!

CARLON plastic pipe is impervious to the enemies of metallic pipe . . . lasts far longer without maintenance. **CARLON** has the best flow characteristics of any pipe available today, and because it will never accumulate scale or sediment, flow rate remains constant for the life of the pipe.

CARLON is lightweight (only ⅛th as heavy as steel) . . . one man can install it without rigging equipment or special tools. This flexible pipe is supplied in long lengths (up to 400 feet) which follow irregular ditch lines and uneven ground surfaces. Because of these long lengths and flexibility, **CARLON** can be installed with far fewer fittings than rigid metal pipe.

Absolutely leak-proof joints can be made quickly with **CARLON** plastic pipe fittings. Flexible **CARLON** absorbs vibration stresses without developing leaks at the couplings. Install it and forget it!

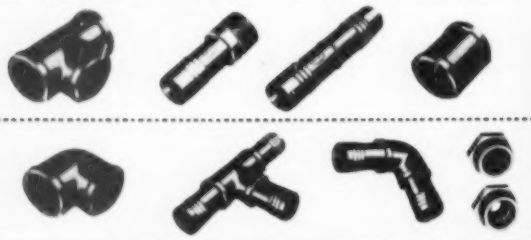
WRITE TODAY FOR CATALOGS.

1944-CP

Every foot of **CARLON** is factory-tested at greater-than-working pressures for more than 8 hours.

CARLON CP

Buy the Pipe with the Stripe!



CARLON PRODUCTS CORPORATION

Pioneers in Plastic Pipe

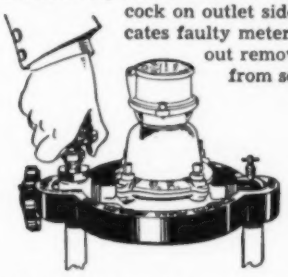
CANADA: Micro Plastics, Ltd., Acton, Ontario • EXPORT: H. E. Botzow, New York City

10300 MEECH AVENUE • CLEVELAND 5, OHIO

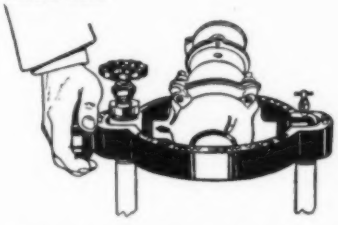
Meter Installation And Removal Now Simplified

With the use of Clark Meter Yokes, installation or removal of meter is a simple job requiring only a few seconds' time. Only one hand is needed, assuring ample visibility in the box.

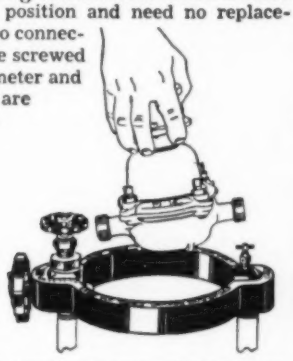
Closing Valve. A few easy turns close the water-way without use of tools. Try-cock on outlet side indicates faulty meter without removing it from service.



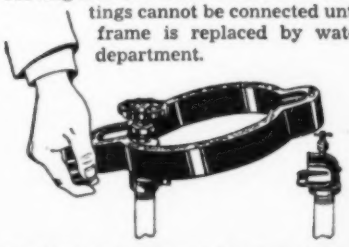
Releasing Meter is accomplished with a few turns of handwheel. Meter tips and rests on yoke frame. It cannot fall over frame and drop to bottom of meter box.



Removing Meter. Just lift out. Gaskets stay in position and need no replacement. No connections are screwed on the meter and no tools are needed.

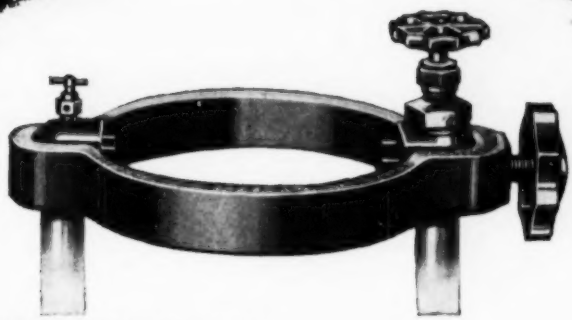


Sealing Service is accomplished by removing frame of Clark Meter Yoke. Fittings cannot be connected until frame is replaced by water department.



For further details and features of these time-saving meter yokes, we suggest that you write the manufacturer, H. W. Clark Co., Mattoon, Illinois . . . mentioning this article and publication.

CLARK METER YOKES
For Easy One-Hand Operation



No. 4 CLARK METER YOKE. Installation is made without bolts, rivets or screws. Outlet try-cock ell determines condition of meter and inlet control valve ell facilitates easy exchange of meters.

Try-cock Ell

Valve Ell

Bronze Ell and Valve with Copper Connections.

SPACER CLAMP ties riser pipes together rigidly at bottom of meter box and automatically liberates meter when handwheel is loosened.

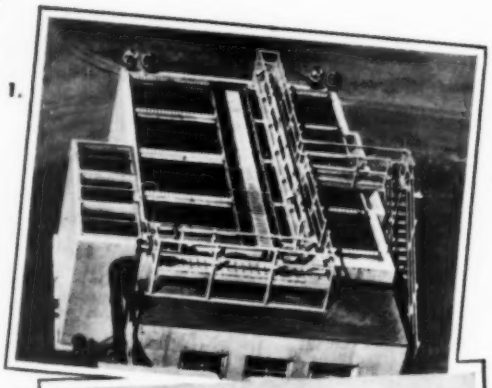
Thanks to simplified design and construction, Clark Meter Yokes permit easy one-hand operation. They are manufactured in a minimum number of sizes to meet every requirement of simplified operation. Because they eliminate so many parts, Clark Meter Yokes are also economical. Costs of meter couplings, curb stop, service box and several pipe fittings are saved. Circular one-piece cast iron frames give added strength, and these yokes are quickly installed on any type of service line. Available for either iron or copper pipe. To get all the details . . .

Write

H. W. CLARK CO.
MATTOON, ILLINOIS

4 *major reasons why Permutit is* WATER CONDITIONING HEADQUARTERS

1.



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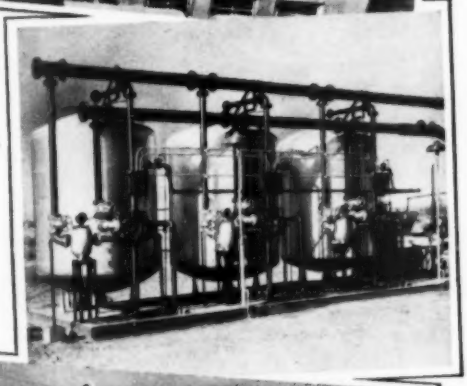

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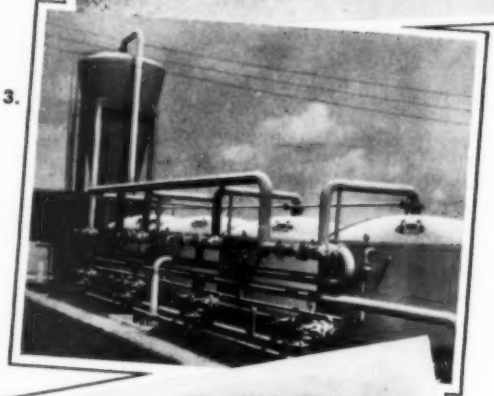

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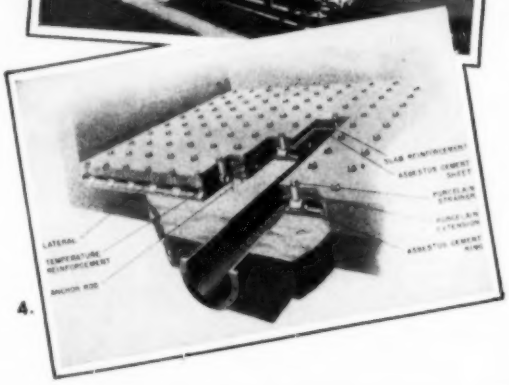


WATER CONDITIONING HEADQUARTERS for 40 years, The Permutit Company pioneered in the application of ion exchange in water treatment. Permutit's *complete* line of water conditioning equipment is engineered and constructed to meet all needs.

1. ***PRECIPITATORS***—A reaction and settling tank requiring less space, less chemicals and less time than previous designs. Permutit Precipitator softens water . . . removes impurities . . . lowers alkalinity content. Available in sizes having daily capacities varying from *one thousand* to *ten million* gallons.

2. ***ION EXCHANGERS***—Hardness in municipal water supplies is objectionable because of its scale-forming, soap-destroying properties. Hardening elements can be *simply* and *cheaply* removed by passing water through tanks containing Permutit Zeolites. Water softening occurs when Zeolites attract the hardening ions—calcium and magnesium—and exchange them for sodium ions.

3. ***SPIRACTOR***—A *space-saving* cold lime-soda water softener with a new principle—*catalytic precipitation*. Hard water plus chemicals enter shell and swirl upwards through catalyst granules. Precipitates deposit on granules by accretion . . . fall to bottom . . . are drawn off and *easily* disposed of. *Total reaction time is 8 minutes.*

4. ***MONOCRETE UNDERDRAIN***—Non-corrodible monolithic construction is rigid and inexpensive. Large laterals and header consist of conduits cast in concrete . . . assure uniform collection and distribution of water. Laterals are formed by inflatable rubber tubes which are removed after concrete has set. Porcelain extension stems, containing porcelain strainers, extend from header and laterals to concrete surface.

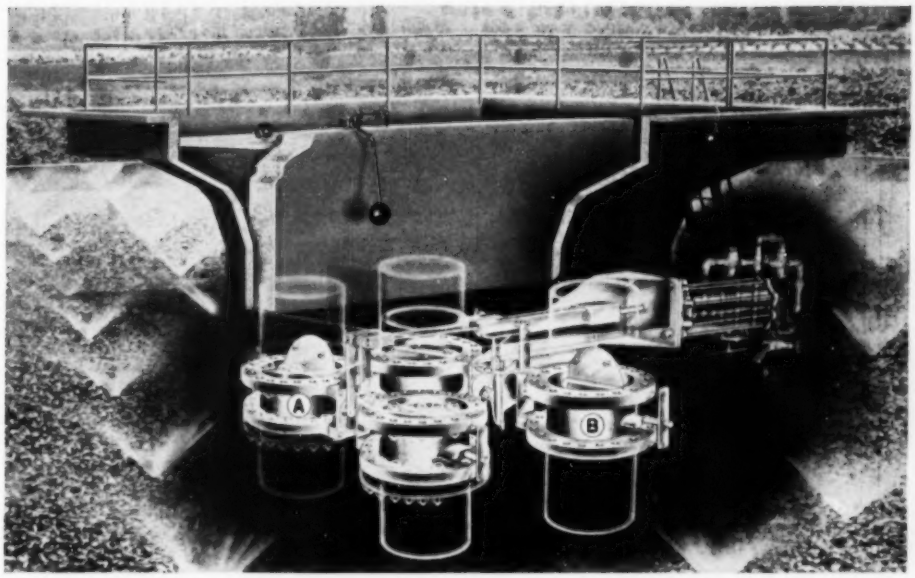
Write for further information on these and other types of water conditioning equipment to The Permutit Company, Dept. W-2, 330 West 42nd Street, New York 36, N. Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

WATER CONDITIONING HEADQUARTERS FOR 40 YEARS

PERMUTIT

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



R-S Simplified Sewage Control System

This dosing pit control system is located in the Ontario-Upland, California, sewage treatment plant. In continuous operation day and night for over two and one-half years, it shows the tandem cycling of the valves which occurs every four minutes.

The system consists of four twenty-four inch heavy duty R-S Valves operated by a single water cylinder through cross linkage. While the far pit is filling through valve (A), the near pit is draining through valve (B) and discharging through the spray nozzles. As soon as the far pit is full, the float control will actuate the water cylinder by means of air operated three way valves, thus draining the pit and filling the near pit at the same time. Handwheel operation is provided for emergency use.

Rugged construction with minimum friction means long life and trouble-free operation for R-S Valves.

Consult your local R-S Valve Engineers, or write direct.

R-S PRODUCTS CORPORATION • 4600 Germantown Ave., Philadelphia 44, Pa.

An S. Morgan Smith Company Subsidiary

DISTRICT OFFICES IN PRINCIPAL CITIES

Getting concrete pipe ready for sewage attack!

Bitumastic No. 50 being applied by spray to concrete pipe. Approximately 20,000 feet of sewer pipe, 60 inches in diameter, were protected by this heavy-duty coating.

CONCRETE PIPE, that carries sanitary sewage, serves under severe conditions. Interior surfaces are exposed to the attacks of domestic and industrial wastes. Unless they are properly protected, these surfaces soon deteriorate.

Bitumastic No. 50 provides effective, lasting protection against deterioration. This protective coating is *extra-thick* and *extra-tough*. It is specially formulated from a base of coal-tar pitch that is, for all practical purposes, impervious to water. It is extremely resistant to the fumes and vapors of many acids occurring in industry and to the dilute solutions of these acids in a sanitary sewer.

Besides being used on concrete, Bitumastic No. 50 also protects metal surfaces against rust and corrosion. There are other Bitumastic Protective Coatings, too—formulated to meet varying conditions.

Send for Free Booklet!

Our new booklet describes Bitumastic Protective Coatings for sewage plant installations. It will help you select the right protective coating to prevent corrosion and deterioration. It shows how you can protect all sewage-plant equipment, above or underground, metal or concrete. Send for a copy. No obligation, of course.

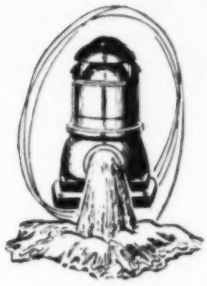
KOPPERS BITUMASTIC PROTECTIVE COATINGS

SOLD THROUGH INDUSTRIAL DISTRIBUTORS

KOPPERS COMPANY, INC., Tar Products Division, Dept. 261-T, Pittsburgh 19, Pa.

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

WATER for Atlantic City's RITZ-CARLTON



DATA:

- —WELL; Drilled by rotary clay-seal process, 850 feet deep in the Kirkwood stratum; double cased and graveled.
- —CASING; 145 feet of 16″ and 747 feet of 12″ steel.
- —SCREEN; 61 feet of 6-guage Armco Iron.
- —PUMPS; Originally equipped with 4-stage 15″ bowls with cast iron impellers. Later replaced with 5-stage 12″ bowl and bronze impeller.
- —MOTOR; Original 25 HP electric still giving good service.

On Atlantic City's famous board walk, stands one of America's loveliest hotels—the Ritz-Carlton. Twenty-eight years ago, the owners turned to Layne for a well and pump installation. In the intervening years—over a quarter century, they have never experienced one fraction of disappointment in the dependability, durability and ever faithful performance of their purchase.

In the twenty-eight years of almost constant operation, the Layne unit has produced more than 1,471,680,000 gallons of water—all the fresh water needed by this great hotel. Upkeep expense since the day installed has averaged less than a hundred and seventy dollars a year. One amazing fact is that the original Armco iron screen is still functioning. Another is that the well was installed by a method that completely sealed off all infiltration of salt water in a most difficult salt water area. Such is the life expectancy, satisfactory operation and generally low upkeep expense of Layne wells and pumps.

For Water Well and Pump Catalogs, write to

Layne & Bowler, Inc.

GENERAL OFFICES, MEMPHIS 8, TENN.

Layne

There are Layne Associate Companies located throughout the country. The one near you already understands the drilling and water bearing formations in your area.

WATER WELLS
VERTICAL TURBINE PUMPS
WATER TREATMENT

LEOPOLD
Glazed Fire Clay
TILE FILTER BOTTOMS

Successfully serving over 200 PLANTS with a daily capacity of over THREE-QUARTER BILLION GALLONS

Check THESE **LEOPOLD** FEATURES:

Permanent • No corrosion or tuberculation • Economical • Equal distribution • Uniform filtration • Low loss of head • No large size gravel required • Proved superiority • No metal in contact with water!

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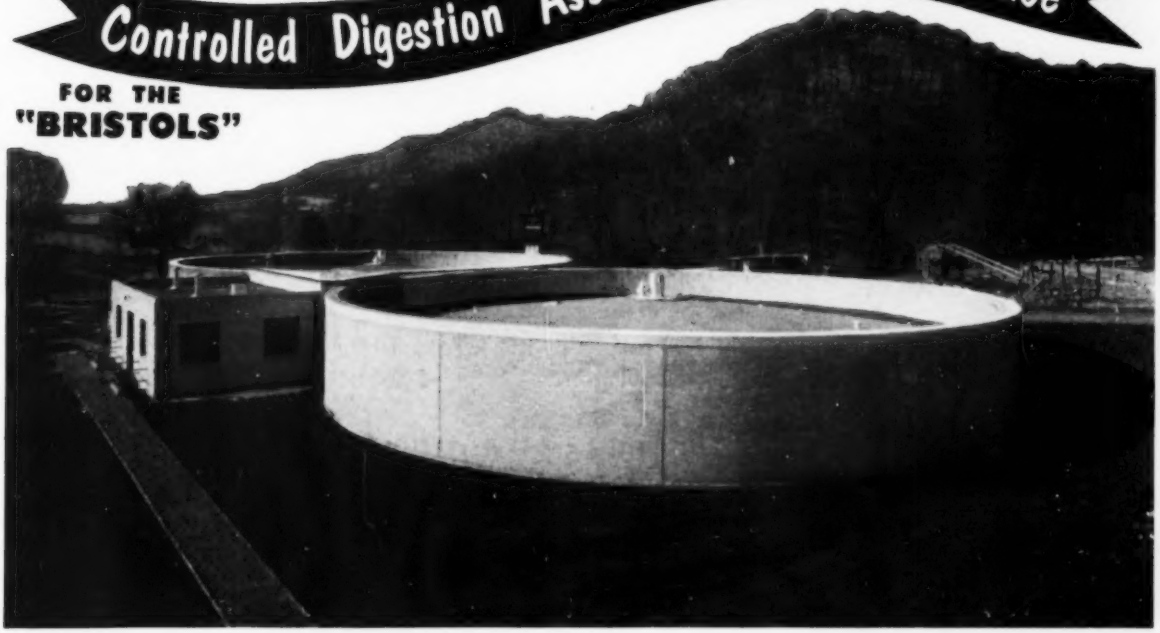
COMPLETE WATER PURIFICATION and SEWAGE PLANT EQUIPMENT
DRY CHEMICAL FEEDERS · FILTER OPERATING TABLES · MIXING EQUIPMENT

P.F.T.

Controlled Digestion Assures Peak Performance

FOR THE
"BRISTOLS"



NESTLED in the Appalachians are the "twin" cities of Bristol, Tennessee and Bristol, Virginia. Both cities are jointly served by a single sewage-treatment plant, of the high-rate trickling filter type.

P.F.T. Controlled Digestion is a highlight of the plant. Two P.F.T. 90' Floating Cover Digesters ably handle digestion of sewage sludge. Each is equipped with a P.F.T. Supernatant Selector piped to a P.F.T. Supernatant Gauge, Sight Glass and Sampler within the control room to provide systematic withdrawal of supernatant liquor. Two P.F.T. No. 750 Digester Heater and Heat Exchangers, gas and oil fired, with accessory group "D" controls, maintain the sludge in the digester at optimum temperature and also provide automatic building heating. P.F.T. Gas Safety Equipment safeguards every phase of sludge gas storage, transmission and utilization.

Future generations will bear witness to the sound investment made by the "Bristols." Another progressive community added to the long list served by safe, economical P.F.T. Controlled Digestion. Wiedeman & Singleton, Atlanta, Ga., were the Consulting Engineers.

P.F.T.

PACIFIC FLUSH TANK CO.

Waste Treatment Equipment Exclusively Since 1893

4241 RAVENSWOOD AVE. CHICAGO 13, ILLINOIS

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"Every individual connected with water purification or sewage works should subscribe to this publication. I have introduced it to a host of friends in this field"

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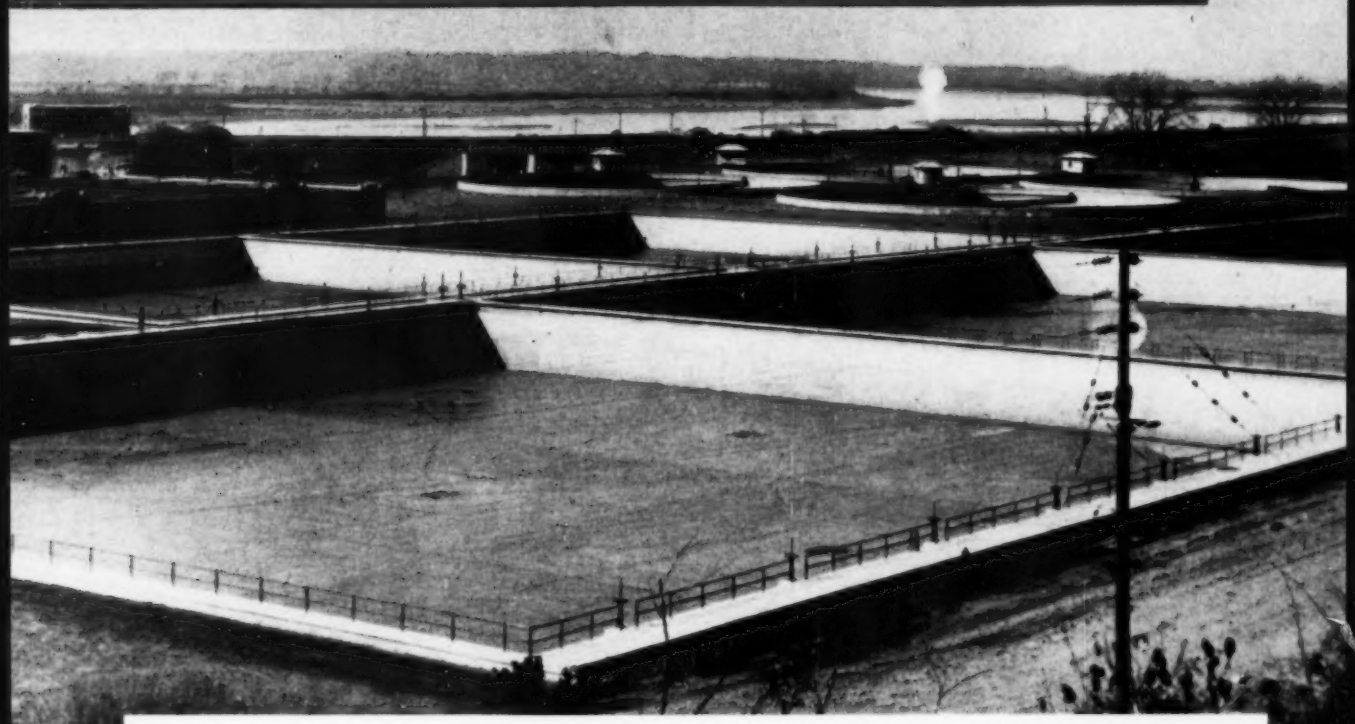
- *If you are interested in both subjects you get all the information in this one monthly magazine.*

IN WATER AND SEWAGE PROJECTS

There's more to CORROSION than meets the eye



Sometimes VISIBLE... Often HIDDEN... Corrosion Strikes Every Installation

This year, the nation's water and sewage works will pay millions of dollars for needless losses created by corrosion... *yet much of this corrosion may never be discovered* until it's too late to protect—and time to pay!

Corrosion is readily detected as rust layers or failing paint on exposed surfaces. But, by far, the major costs of corrosion come from hidden areas—where only minute inspections and constant care can prevent costly failures.

YOU LOSE IN A "WAITING GAME"

Don't wait for rust or other visible signs to appear. Visible or hidden, corrosion will destroy costly equipment... increase maintenance costs... and contaminate vital water supplies, thereby creating needless wastes that will cost you thousands of dollars.

YOU CAN PREVENT NEEDLESS WASTE

Check now for corrosion's presence. Double-check areas that may be vulnerable to *hidden corrosion*. If you would like help, an AMERCOAT Field Engineer will gladly assist you in making a thorough analysis. There is no obligation.

What is AMERCOAT?

AMERCOAT is a method of corrosion control. Not just a single product, but a complete LINE of coatings, individually formulated to solve or control specific industrial corrosion problems.

FOLLOW THE LINE OF [illegible] RESISTANCE... PROTECT WITH *Amercoat!*

AMERCOAT CORPORATION

4809 FIRESTONE BLVD., SOUTH GATE, CALIFORNIA

CHICAGO, ILL. NEWARK, N. J. JACKSONVILLE, FLA. DALLAS, TEX.

He Went Out to Meet Them

WITH FLARES AND WHISTLES and blaring bugles, the Reds had been attacking fanatically all night. Wave after wave they came, in overwhelming numbers.

By dawn, Jerry Crump could see that his position alone was keeping them from overrunning L Company. Twice he went out to meet them with his bayonet. Once he retook a captured machine gun. And four times he left shelter to bring in wounded comrades.

Now, an enemy soldier crept close unobserved. He lobbed a grenade. It landed squarely among the wounded men. Without a second's hesitation, Corporal Crump threw himself upon it, smothered the explosion with his own body, and saved his four companions' lives.

"I got hurt," says Jerry Crump, "but I got back alive. Because our armed forces have the finest medical equipment in the world—even at the front. And *you* helped put it there by investing in United States Defense Bonds."

Bonds are savings. But they mean *production power*, too. Helping provide the arms and equipment and care of every kind that give a fighting man *more* than a fighting chance.

Corporal Jerry Crump U.S. Army Medal of Honor

Now E Bonds pay 3%! Now, improved Series E Bonds start paying interest after 6 months. And average 3% interest, compounded semiannually when held to maturity! Also, all *maturing* E Bonds automatically *go on* earning—at the new rate—for 10 *more* years. Today, start investing in United States Series E Defense Bonds through the Payroll Savings Plan at work.

Peace is for the strong! For peace and prosperity save with U.S. Defense Bonds!

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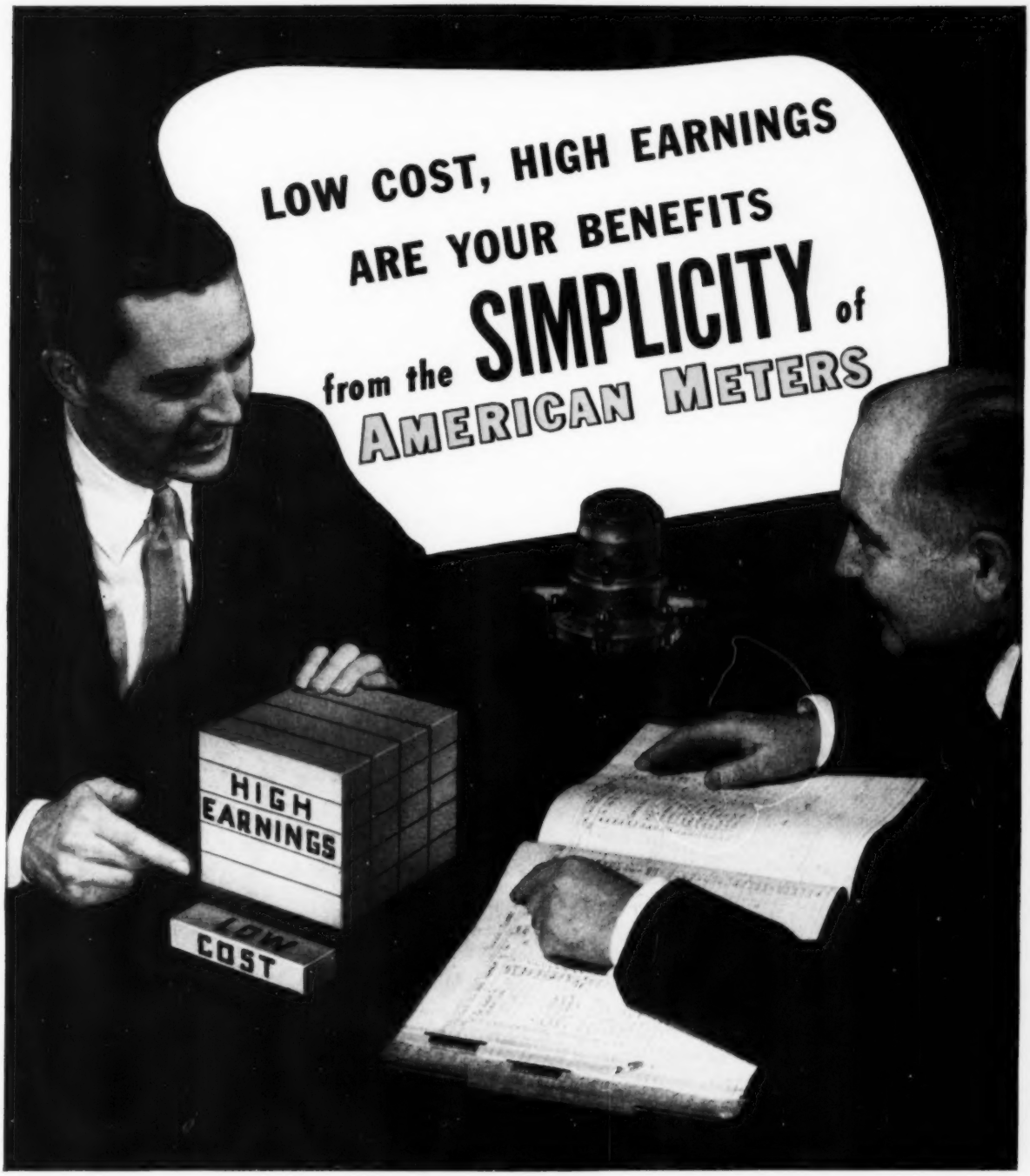

• American Meters are accurate and operate for decades without attention. They earn full revenue for you at low first cost and lowest maintenance cost. This is due to the simplicity of design—fewer parts—simpler castings—reduced opportunity for failure. American Meters have become a standard in hundreds of communities — cities and villages — and are giving full value.

BUFFALO METER CO.

2909 MAIN STREET, BUFFALO 14, NEW YORK

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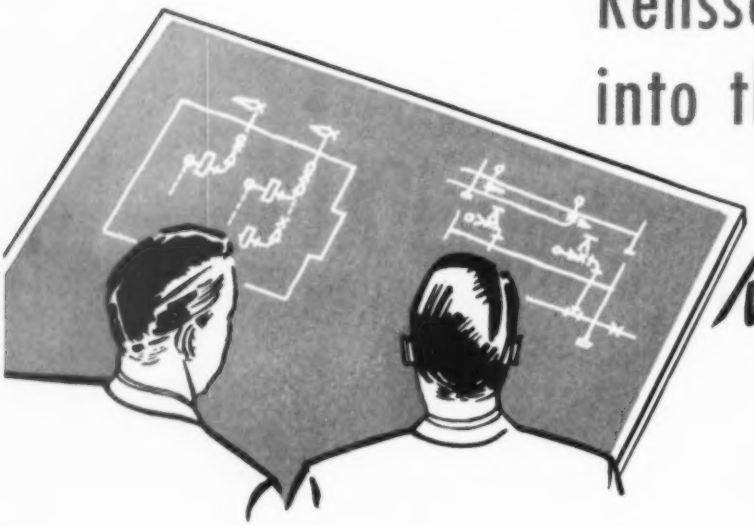

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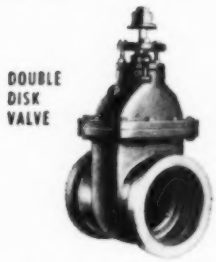

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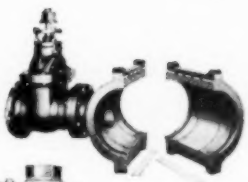

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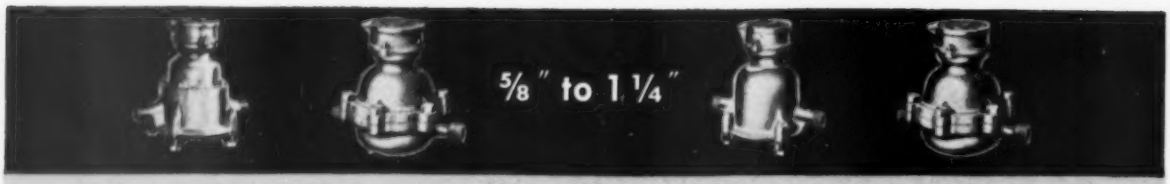

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WATER & SEWAGE WORKS

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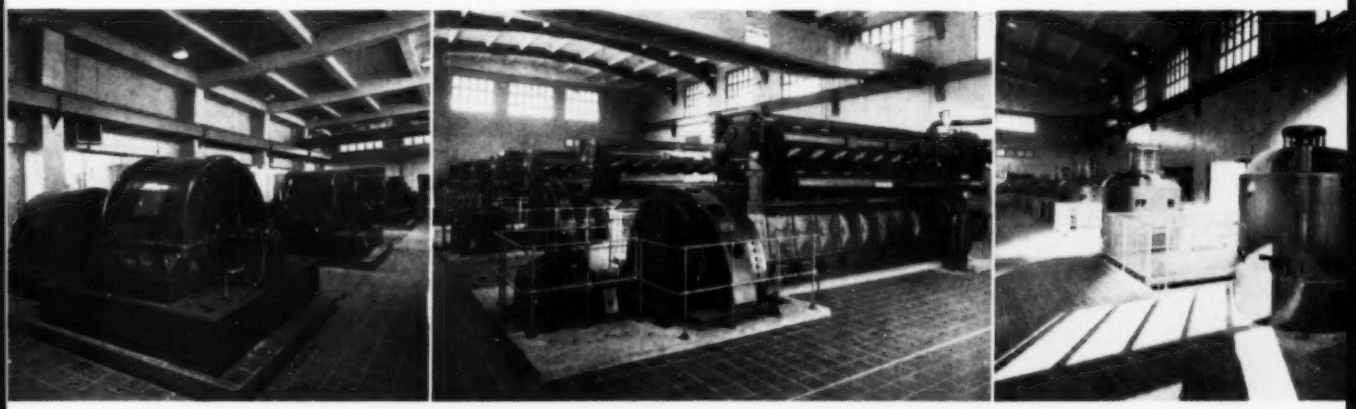


Owl's Head—New York's Newest and Most Modern Treatment Plant

Sewage Works Developments During the Year 1952

A Review of the Year's Problems and Progress

by E. SHERMAN CHASE, *President, Federation of Sewage and Industrial Wastes Assns.*

HAVE you ever wondered what a layman would pick out as significant from the mass of technical papers on sewage and industrial wastes treatment problems and on stream pollution control? Well, if you have, the following review of the 1952 literature by our librarian, Miss Bettyanne Hayden, is an answer. Theoretically and according to precedent, protocol, and propriety, this review should have been prepared by the senior (many years) author but, as a matter of fact, his duties as president of the Federation of Sewage and Industrial Wastes Associations, and the coincident necessity for earning bread and butter, have left him little time for extra-curricular activities. Consequently, except for some editing, a few depletions and additions, the senior author (alleged) disclaims responsibility for the views expressed but does accept responsibility for the opinion that seeing ourselves as others see us is a salutary experience. Incidentally, Miss Hayden reviewed some eleven different journals and periodicals. *En avant.*

Progress on Many Levels

The march forward in the field of sewage and industrial wastes treatment by the army of biologists, chemists, and engineers, was advanced in 1952 by the increased interest shown by the general public in problems involving pollution abatement. In turn, public awareness is resulting in increased cooperation on five levels—international, federal, interstate, state, and local. Although each pollution problem is of nationwide interest and concern, its solution is basically local, and technical handling of each problem is most complex.

The Canadian-United States treaty concerning the pollution of boundary waters stands at the top of the five levels of cooperation. The Water Pollution Control Division of the United States Public Health Service is perhaps the most significant agency representing Federal legislation. The New England Interstate Water Pollution Control Commission and the Ohio River group of eight states, are typical of interstate agencies. On the local level, municipalities and industry are joining in cooperative projects such as those in Middlesex County, New Jersey, and in Allegheny County, Pennsylvania.

The country's leading universities are contributing more and more research to solving problems of sewage and industrial wastes treatment. To mention a few which are making significant studies at the present time: the University of California is the base for studies of waste disposal where state appropriations have been made for the study at Berkeley of animal food products developed from sewage; Ohio State University is working on new plastic pipe; and the

Mr. Chase is a partner of Metcalf and Eddy, Engineers, Boston, Mass. Miss Bettyanne Hayden, librarian of Metcalf and Eddy, has collaborated with Mr. Chase in the preparation of this review.

The Dorr Co. Photo

Oklahoma City, Oklahoma—25 mgd Southside treatment plant where three stage clarification and two stage filtration meets requirements of low seasonal dilution

University of Florida is investigating the mechanical units used in wastes treatment.

Public sentiment for water pollution abatement has resulted in pressure for corrective measures in the form of sewage and industrial wastes treatment plants. The sanitary engineering approach to their problems has been accepted by industry, and the year 1952 showed an increasing number of sanitary engineers being employed by both industry and municipalities. Sanitary engineering concepts offer effective and economical solutions to treatment processes.

One need has become evident in this demand for more effective sewage and industrial wastes treatment—namely, evidence of a lack of properly trained personnel. As in the past, there has been plenty of attention given to the design of plants and various processes, but less attention has been devoted to the operating end of the picture. No matter how modern the plant, how extensive the operations handled, or how up-to-date the equipment, the treatment plant will be a municipal headache unless properly staffed. Gone is the day when a minor public works employee can be elevated to the position of operating a laboratory controlled treatment plant without first having a basis of technical training.

Sewage Works Management —A New Approach

Hand in hand with this sanitary engineering advance is the new approach to sewage works operation and finance. Many municipalities, having cleared their vision, are doing away with some of the outdated divisions in public works departments and coming up with a happier arrangement. Instead of the old Department of Streets and Sewers, the more sensible division of Department of Sewers and Sewage Treatment is evolving. Since water mains are naturally considered part of the water utility system, why should not sewer lines be considered part of the sewage collection and disposal system? Merging of the two engineering services into one should give superior results in efficiency, in operating, and in maintaining the sewage works.

Developments of Interest

Horizons are ever widening in wastes treatment. With the development of new drugs, new products, new kinks, comes a new challenge to find new methods of treatment.

Fairbanks-Morse Photo

Kansas City, Mo.—Three sets of pumps in suburban pumping stations. Each pair (rated at 1400 gpm, 78 ft. head) operates in series as a two-stage pumping unit

General Electric Co. Photo

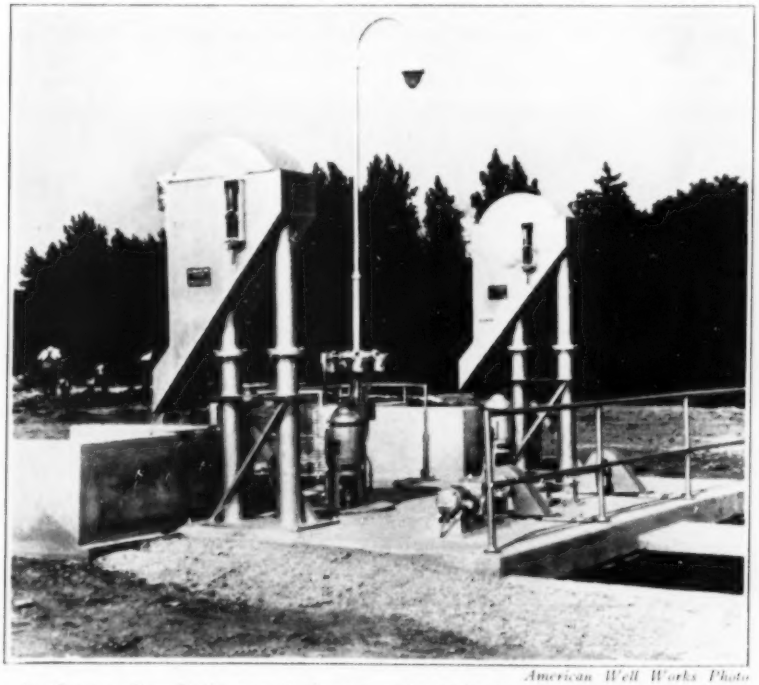
San Francisco, Calif.—150 mgd North Point treatment plant provides preaeration, sedimentation, and chlorination. Sludge is pumped seven miles for treatment

Ultrasonic Vibrations

In 1953 much more should be heard about treatment of wastes by ultrasonic vibrations. Aware of the potentialities of ultrasonic vibrations, the Massachusetts Institute of Technology is presently working on various uses of acoustic energy in the sanitary field; investigators have reported that these vibrations are effective in killing E. coli, but that the present cost makes common usage impractical.

Biosorption

A modification of the Gould process of step-aeration is in operation at Austin, Texas. The process—biosorption—has now been adapted to the treatment of industrial wastes although it is still in the early stages. Biosorption is a high rate biological treatment process in which raw sewage is mixed briefly with activated sludge. The mixed liquor goes to a settling tank, the effluent from which is low in B.O.D. and suspended solids. Then the settled sludge, including the pollutants, is treated in an aeration compartment by aerobic digestion and reactivation prior to recirculation. Two independent groups in Austin, Texas, and Ridgewood, N.J. developed the process. At present, an H. J. Heinz cannery wastes plant is reported to be using the process successfully at Chambersburg, Pa.



American Well Works Photo

La Grange, Ga.—Duplicate grit elevators and grit Hydrowash units are a modern feature of this new sewage treatment plant

Radio-Active Wastes

With increased development of the atom bomb and radio-active material, entirely new fields are opening. According to F. W. Kittrell, sanitary engineer at Oak Ridge, the Oak Ridge National Laboratory is producing radioisotopes which have unique radioactive characteristics. These characteristics make the isotopes extremely useful tools in research, biology, medicine, agriculture and industry. But radioisotopes discharged with wastes into sewers create a disposal problem. At present, the most common use of radio-active substances is pretty much limited to hospitals: there is no fear of harmful effects because the volume and rate of flow of sewage ordinarily are adequate to dilute the radio-active material discharged.

Radioisotopes may become a boon in the sanitary engineering field. They can assist in solving the problem of flow through pipe networks, problems

Meriden, Conn.—Sewage sludge grinder prepares sludge for spreading

Greenwich, Conn.—Dried sewage sludge stored on concrete platform

of corrosion, problems involving accuracy in recording and controlling water levels. But, eventually, the disposal of isotopes will become a major problem unless the research keeps up with the production end. Mr. Kittrell reports that shipments of radioisotopes from the operations division of the Oak Ridge National Laboratory for experimental traces and therapeutic purposes has increased six or seven fold since 1947. Iodide (I^{131}) and phosphorus (P^{32}) constituted over ⅔ of the shipments of radioisotopes, and the possibility of their entry into sewers and receiving waters must be recognized. The main problem involved lies in the fact that there is difficulty in identifying the radio-active material in wastes by the customary tests and observations. Other problems result from the tendency of many radio-active materials to adhere to surfaces with which they come in contact, and from the length of time radioactivity exists.

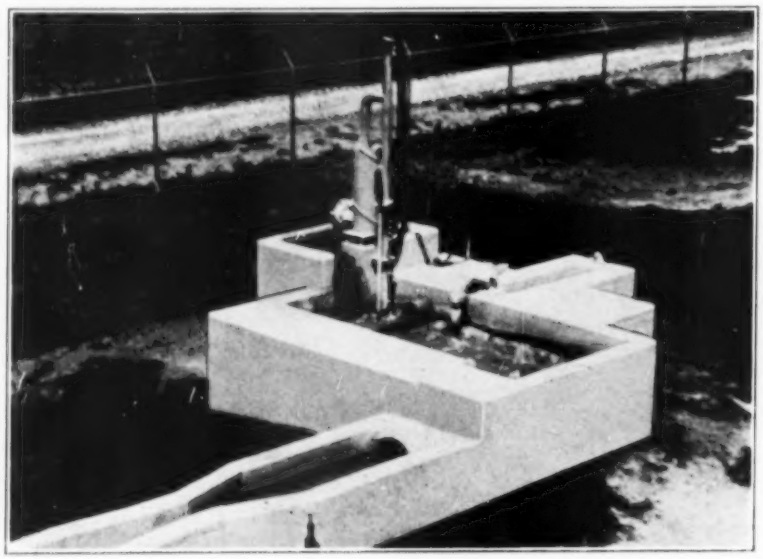
In the case of atomic energy wastes, the industry does not return them to normal outside re-use or scrap. Since radioactive products are rare and costly, a high degree of reclamation of the product from wastes is economically feasible. The industry channels its radioactive obsolete facilities or materials to re-use within the industry under controlled conditions. A new product, "Radiacwash," has been developed as an anti-radioactive liquid compound for removing radioactive contaminations from laboratory equipment, garments, and other affected parts. Here is a big challenge for 1953.

Usable Products From Waste

Disposing of by-products from sewage is still a major question waiting solution, although 1952 found the production of usable products from wastes continuing to interest the general public. Hope persists that sewage can be so treated as to accomplish not only adequate purification but to return a profit.

One product developed during 1952 was heralded as "The greatest discovery in the field of animal husbandry in a generation." The Battle Creek, Michigan, plant developed a product known as penicillin mycillium from sewage sludge. Emerging from the processing looking like finely ground coffee, this product is labeled D-P-M. Mixed in small amounts with regular animal food, it is claimed to produce amazing increases in animal growth. Scientists believe that the result is due to action of D-P-M upon harmful bacteria in the animal digestive system. As these bacteria are competing with the animal for nutrients, the action of D-P-M apparently makes it possible for the animal to assimilate its food better. Thus, from sludge at Battle Creek (which had such an odor that it was necessary to bury it at the rate of 20 tons a day), comes a new product which may be of great importance.

Along the same lines, Milwaukee, Wisconsin, has developed from activated sludge a product called Vitamin B_{12} which has been successfully



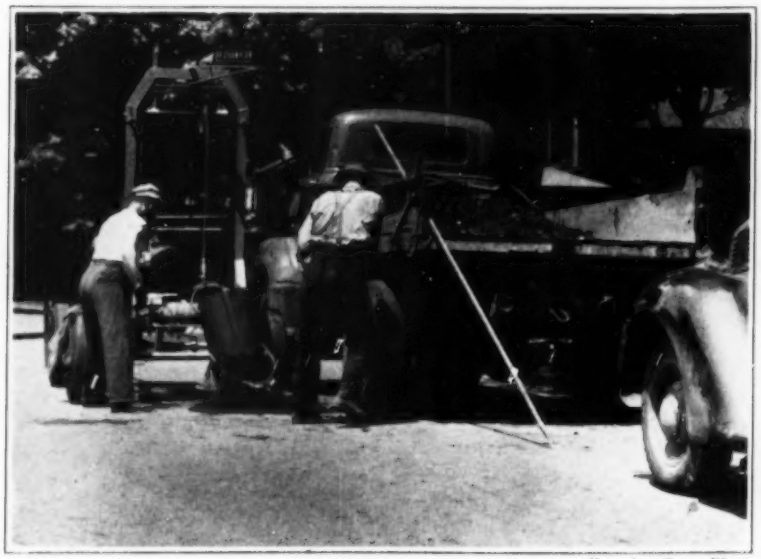
Chicago Pump Co. Photo

Bellaire, Texas—Aer-degritter using swing diffuser assembly. Air lift raises grit to dewatering hopper

Foaming Problems—Effect of mineral oil as defoaming agent. Left—before adding oil; Center—45 minutes after adding oil; Right—2.5 hr. after adding oil

used for animal feed. The next step may be development of a food for human consumption. Although this is highly speculative, who knows? If a human food product ever is developed from sludge, one can visualize the millions of dollars poured into advertising to condition people to accepting it!

Scientists who have become increasingly concerned with methods of augmenting the world's food supply are directing their creative efforts to algae as possible sources of proteins and fats for human consumption. Consideration of the possible production of food from sewage has developed from a study of sewage treatment by oxidation ponds (in which green algae are used to supply the oxygen). From studies now being made at the University of California, it is believed that a continuous harvest of the algae would yield a food having up to 50 per cent protein content. Again, the biggest difficulty in the distribution of a product known to originate in sewage might be the overcoming of popular prejudices. People will have to be made "algae food conscious," as they have become within the last year of chlorophyll: chlorophyll in tooth paste, dog food, soaps, deodorants, ad infinitum. It has even been suggested that if chlorophyll were added to sewage it would remove all odor—though perhaps there should be no odors at all, due to the amounts of chlorophyll tooth paste washed down the household drains daily!



Champion Corp. Photo

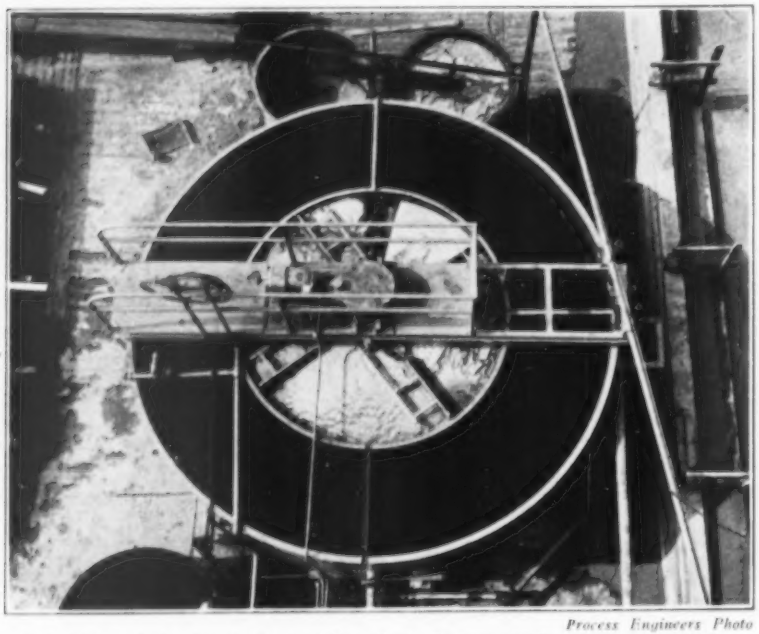
Titusville, Pa.—Municipal sewer cleaning equipment. Bucket is operated by water cooled engine

Power from Sludge Gas

Most sewage plants with separate sludge digestion facilities, in the United States and Europe, store and use sludge gas for fuel or to run the power plant. The Hyperion Sewage Treatment Plant of Los Angeles is a noteworthy example of a plant that uses this product as a source of power, and it is considered the largest and most modern of its type in the world.

Water from Sewage

A possible method of augmenting a water supply, is through the reclamation of sewage and industrial waste effluents. Usable water, meeting specific requirements, can be produced from most sewages; although many problems are involved. Broad irrigation abandoned many years ago in England and eastern United States is still used to some extent in several countries—Spain, Italy, Germany, France. In the U.S. sewage farming is mostly limited to the arid and semi-arid regions of southwestern states. Reclaimed water has been used for irrigating parks, golf courses, lawns, and for the operation of sanitary systems for some time. Industrial use of sewage effluents, as at Baltimore, offers interesting possibilities.



Process Engineers Photo

Industrial waste treatment: Meat packing plant—Flotator clarifier unit (pressure flotation and gravity settling) for grease recovery and waste treatment

Reclaimed Materials

The Korean situation has caused a need for the recovery of chromium and chromic acid from waste materials. This is quite successfully done with an ion-exchange process. Another item which is worth reclaiming from sludge is carbon which has a radio-active character; this presents many possibilities when isolated and leashed. Still relatively new, and in the early experimental stage, is the development of hormones from waste material. Little can be said of this although the future is fraught with possibilities which will arise as development occurs.

Many plants all over the country are using products from wastes, and New York City is a good example of one location utilizing the products to a great degree. Over 1,400,000 cubic feet of sludge gas were used each day at five sewage treatment plants provided with gas engines. Grease amounting to 2,000,000 pounds was sold, and a synthetic topsoil utilizing 2,000,000 cubic feet of digested sludge was used. At the Hyperion plant of Los Angeles, nearly 5,000,000 cubic feet of gas is available per day for power and heat; and about 2000 tons of dried sludge per month are sold for fertilizer use.

Major Problems During 1952

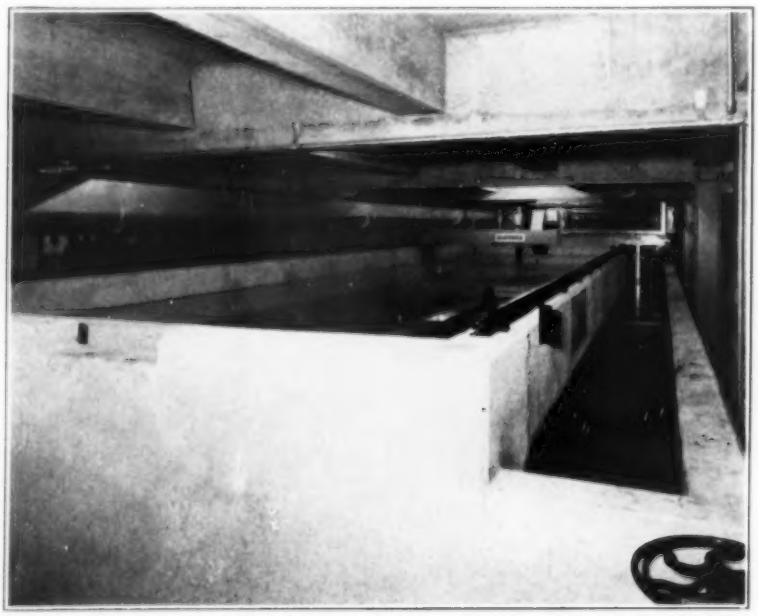
The problem which caused the most stir during 1952 was that of "Foaming" or, as some prefer to call it, "Frothing." Authorities are divided into two camps, with much literature and discussion issuing from both. One school of thought attributes the cause of the headache to the modern soapless detergents, while the other school claims these have nothing to do with it at all. No matter what the cause, foam is present at many treatment plants as a problem to be dealt with. Of such magnitude is the problem that the annual meeting of the Federation of Sewage and Industrial Wastes Associations set aside a half day session for a symposium on the subject. The only conclusion was rather complete disagreement among the "experts."

The Case Against Detergents

Since 75 percent of the detergent output is used domestically, these products are definitely here to stay, and future developments of these substances and of their effects on sewage and sewage treatment practice will be of general interest. A product of chemical industry channelled into every home by radio and TV, sales indicate that 1,200,000,000 pounds of synthetic detergent are used in homes of the U.S. each year. The big selling point up till now has been the stability of the product, yet this very quality plagues the sewage plant operator!

Found at all plants that employ diffused air types of activated sludge for secondary treatment, or the contact aeration process, the difficulty is fourfold: excessive amounts of froth make it impossible to see the secondary units and so prevent proper maintenance and operation; the blanket of froth rises so high it can be blown far afield—so creating a nuisance; the froth carries grease from the sewage with it, depositing it on walls, pipes, walks, clothes, etc.; and the carry-over of emulsified grease may well have adverse effects on biological filters.

Detergents fall into three categories, cationic compounds which in-



Hardinge Co. Photo

Industrial waste treatment: Paper mill, York, Pa.—Automatic backwash sand filter for reclaiming suspended solids from waste water

clude those used industrially, anionic compounds of the Duz, Fab, and Tide variety used domestically, and the nonionic compounds such as All and Glim. Sewage plant operators generally think that the domestically used detergent is responsible for most foaming, and in the one town intensified foaming was noticed first after a manufacturer had distributed throughout the town, one-ounce samples of a leading detergent. These samples were passed out on a Friday and foaming started on Saturday with Monday's foam rising as high as five feet.

The Case for Detergents

Refuting testimony that detergents cause the foaming, C. H. Scherer, chemist of the San Antonio, Texas, Sewage Treatment Plant, claims that more than 2,800 pounds of a synthetic detergent, Tide, were added to one of the aeration tanks without causing excessive frothing. Additional tests with low concentration of mixed liquor solids are in progress to determine if the detergent concentration is in the solid phase of the sludge or remains in the liquid phase. Mr. Scherer claims that frothing can be controlled by maintaining a sufficiently high concentration of mixed liquor solids in the aeration tanks and that the addition of high concentrations of synthetic detergents do not cause frothing. Some authorities believe that his tests are not comparable to conditions prevailing when detergents originate in the house sewage.

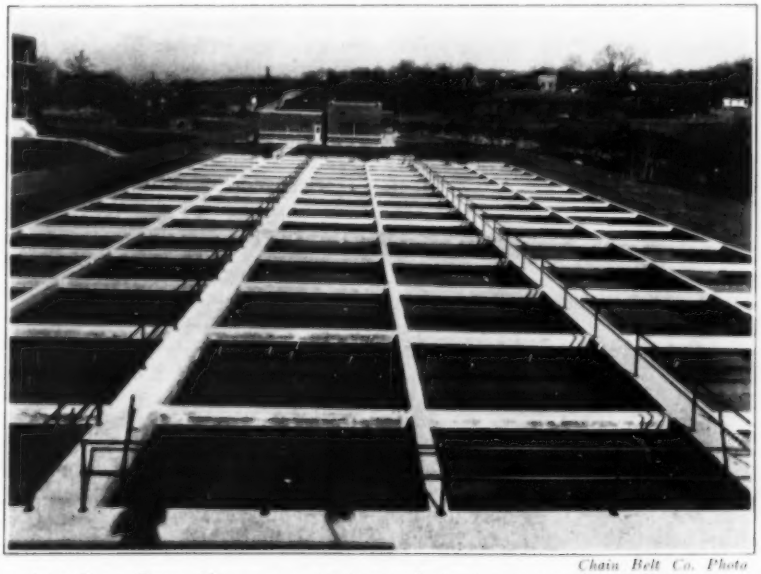
From studies made by the University of Massachusetts Department of Bacteriology and Public Health come statements that there is no evidence household detergents in concentrations likely to be present in sewage at any given time, would be detrimental to the proper functioning of septic tanks.

Builders—Providence Photo

Los Angeles, Calif.—Control panel at Hyperion plant has air to sewage direct reading ratio gauges

Handling the Foam Problem

No matter what the cause, the problem still exists. Rudolfs of Rutgers University suggests promoting the sales of cationic detergents instead of the other two. At the present time the situation has been handled in a variety of ways. In many plants in Scotland, oil is added to the aeration tanks to reduce froth. In Motherwell, England, small amounts of mineral lubricating oil are added with successful results. Here in this country at Cranston, R.I., "Depuma," a defoaming agent is used. Both in New York City and Los Angeles, defoaming agents are used to some extent. At the Hyperion plant, sprays of final effluent, with an anti-foam agent added at critical times, are used successfully to keep down foam. Other plants use the spray method. At the 26th Ward Plant in New York City, spray piping equipment is used for injecting a controlled dose of anti-foam. Neither the spray nor an anti-foam chemical alone has been found wholly satisfactory, but the combination appears to provide a complete and economical control.



Chain Belt Co. Photo

Waterbury, Conn.—New sewage treatment plant using rectangular clarifiers

Various manufacturers of detergents are making intensive studies of their products. Procter & Gamble, working in Texas, provides a good example of this cooperation. Although there are detergents minus

Chicago Pump Co. Photo

Columbus, Ohio—Sewage treatment plant has Chicago-Wiggins pontoon covers (six in foreground) and two new gas holders

the foaming quality, they have many disadvantages in marketing. It will be a long pull for sudsless cleaners.

W. B. Stevens of the Socony-Vacuum Oil Company reports the company's interest in excessive froth in many activated sludge treatment plants. This company has come up with a laboratory product, a compounded oil containing a critically balanced proportion of organic additives. This new product shows outstanding ability, according to Mr. Stevens, to control the excessive froth in activated sludge plants and also appears to be applicable to many industrial waste foam problems. This product is marketed under the name of S/V Foamrex W.

Through all the conflicting data available on the subject of detergents, one fact is clear: although the degree of purification effected by secondary treatment processes may not be reduced by increasing the suspended solids loadings or BOD loadings, adverse effects may result through the carry-over of emulsified grease, as more and more synthetic detergents are used domestically. Furthermore, there is the possible requirement for greater supplies of air to maintain adequate aerobic conditions.

It seems as if the witches of 1952 were chanting, *"Boil, boil, toil and trouble — Cauldron burn, cauldron bubble."* Even ducks are being affected by the boom in use of detergents. Where detergents are present in sewage discharged into salt water bays and inlets, ducks can't stay afloat. Duck feathers normally have an oily coating which protects them from water. Detergents dissolve this coating, permitting the feathers to become water logged; result, drowned duck!

Garbage and Sewage

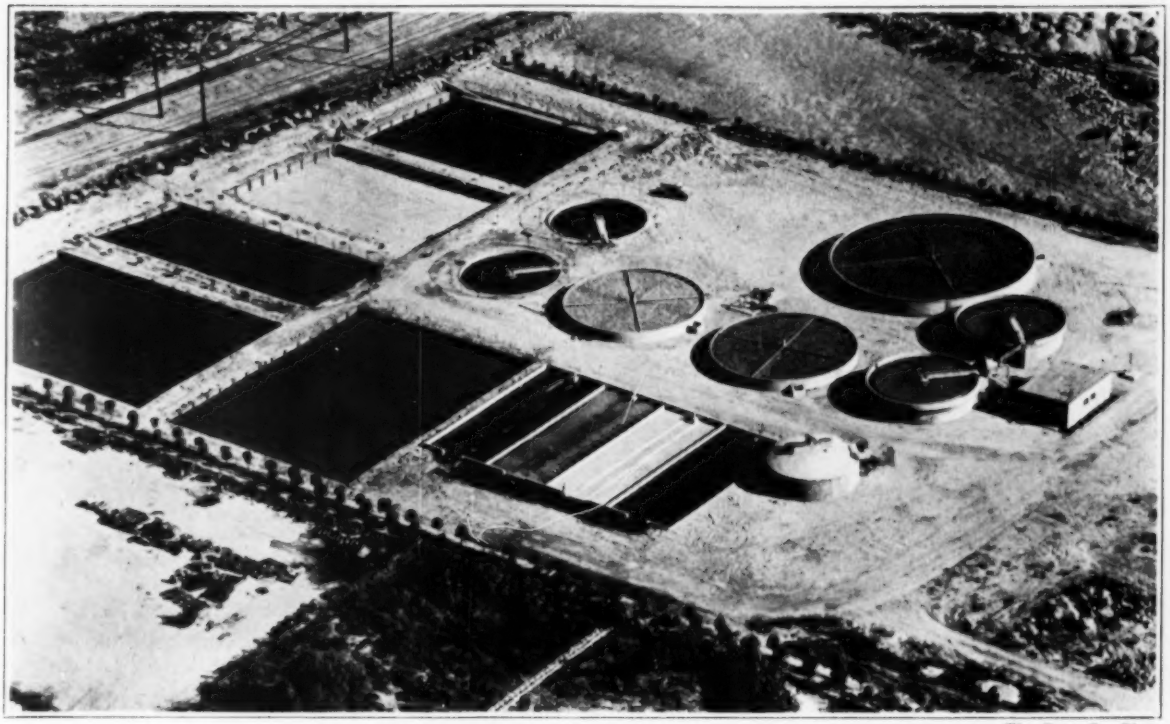
The year 1952 saw another matter continuing on the side of the ledger marked Controversial—the effect of ground garbage on sewer systems and sewage treatment plants. Home garbage grinders have been in use for about 15 years, but their widespread use took a tremendous jump during recent years—with the number installed still rising. When sewers are properly designed no problem exists, but in flat grades, combined sewers, pumping wells, and siphons the problem can be real. Some authorities frown on domestic garbage disposal units, while others allow municipalities to install home units and pay for them on a rental basis. The subject will not be closed for some time as it has been estimated that, by 1965, 45 per cent of all the homes in the U.S. will have these grinders. Some cities have dual-disposal of garbage and sewage at the sewage treatment plant where the garbage is ground and added to the raw sewage or directly to the digesters. At Indianapolis, reduction of garbage has been abandoned and the garbage has been ground and discharged to the sludge lagoons of the sewage plant.

Varied Problems

Other major problems have arisen during the past year at various treatment plants throughout the country. Among these are: the need for greater volumes of air at activated sludge plants in some cases, the problem of scum control in digestion tanks, the reduction or muffling of noise from high-speed centrifugal blowers, the control of fumes and dust from sludge drying plants; and other similar difficulties. Sewage treatment has not yet become a simple push-button operation.

The Construction Situation

In the wake of the 1948 Federal Water Pollution Control Act, reports from various parts of the country show the installation or planning of more and more sewage and wastes treatment plants. During the first half of 1952 alone, according to the NPA, Department of Commerce, water and sewage construction permits or approvals reached the $3,000,000,000 mark. During a three-month period the Water Resources Division issued permits for construction in-



The Dorr Co. Photo

Industrial waste treatment: Azuza, Calif.—Two-stage Biofiltration plant treats brewery wastes (0.67 mgd) to prevent pollution of underground water supply

volving 1032 projects. Gerald E. Arnold, Director of the Division, estimated water projects valued at $271,830,958 and sewage construction at $282,252,593.

Arnold reported the materials situation for water and sewage systems as tight, due to production for defense needs. He also foresaw the substitution of other materials for copper. The use of plastic pipe, as before mentioned, is one item receiving wide study and investigation. Until June of 1952 the steel situation was improving with relaxed controls in sight, but the steel strike set the sights back many months. The NPA restrictions are expected to carry well into 1953.

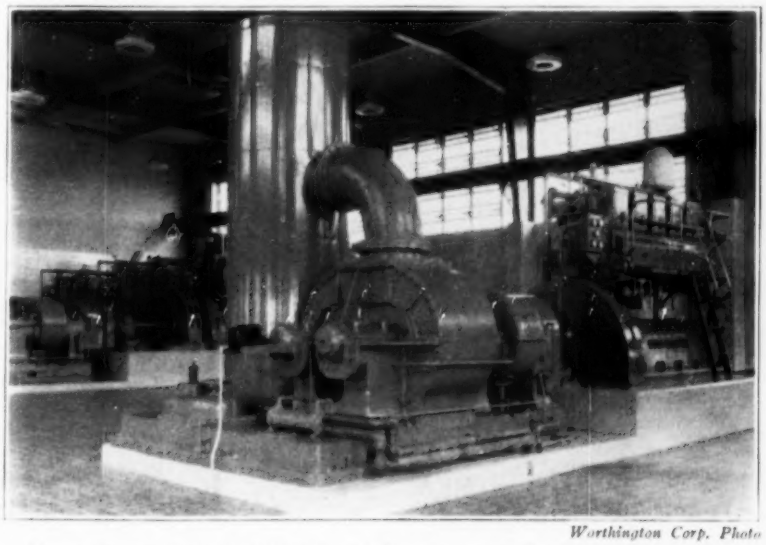
New Treatment Plants

Pittsburgh

The sewage works project of the Allegheny County Sanitary Authority is uniquely designed and also claims another "first." It is the largest sewage works project constructed with revenue bonds to be liquidated exclusively out of sewer service charges.

Particularly interesting is the proposed method for the concentration of raw sludge. Laboratory experiments over a period of two years and pilot plant operation over a period of 16 months have demonstrated that the concentration of raw sludge to an average dry solids content of 18 per cent is feasible and practical. As the result, sludge concentration with direct incineration of the concentrated sludge has been adopted.

According to John F. Laboon, chairman of the Allegheny County Sanitary Authority, raw sludge will be discharged daily from the sedimentation tanks to concentration tanks after preheating to a temperature of 35° C. The sludge will remain in the concentration tanks for a period of 5 days. Experiments show that the sludge rises to the top in the first 24 hours in a mass buoyed by gases generated by first-stage decomposition. The generating gases continue to compress the floating sludge during the remainder of the 5-day period. At the end of five days the subnatant liquor will be drained off to the pre-



Worthington Corp. Photo

Nassau County Works, L.I., N.Y.—Two sludge gas engines (supercharged dual fuel) drive positive displacement blowers for compressed air needs

aeration tanks and the concentrated sludge pumped to the incinerators.

The intercepting sewer system will have a number of deep vertical connections. Their design and the method of operation and control of the intercepting sewers involve interesting problems and features. The proposed interceptor system and sewage treatment plant will produce the specified stream pollution abatement for the area to be served.

At present-day prices, the cost of sewage service to the average householder in Pittsburgh is estimated at $10 annually, or roughly 85 cents per month.

New York City

New York City stands out in the front ranks in 1952 with a $317,000,000 pollution abatement program. Three new sewage treatment plants have been put into operation during the year with the fourth closely following. By 1959 additional projects will round out the program, one which was given impetus in 1950 by the adoption of the sewer service charge to finance the construction and operation of sewerage and sewage disposal systems. By the end of 1953 seven projects will have been completed. The three put in operation in 1952 are the Owls Head high rate activated sludge plant, the Hunts Point conventional activated sludge plant, and the Rockaway high rate activated sludge plant.

About $114,000,000 has been spent so far by the City of New York on its sewage disposal works. By the end of 1953 the sum will be around $167,000,000 and the completed program will have cost about $317,000,000.

Located in Brooklyn, the Owls Head plant started operations in February—the first plant in New York City designed exclusively for the high rate activated sludge process. Hunts Point, situated in the Bronx,

Collaborator
Miss Bettyanne Hayden
Librarian
Metcalf & Eddy, Engrs.

is a conventional activated sludge type plant using step-aeration. It provides screening, pumping, grit removal, preliminary sedimentation, aeration, final sedimentation, sludge thickening, sludge digestion, disposal of digested sludge to sea by vessel, and utilization of sludge gas for power and heating. Handling Jamaica Bay sewage with the three other Jamaica Bay plants (Jamaica, 26th Ward and Coney Island) the Rockaway Project will put a stop to pollution which for years has threatened the recreational value of the area.

Los Angeles

The Hyperion sewage disposal plant, the largest plant of its type in the world, contains so many engineering "firsts" that each section of the whole system is a plant in itself. The $42,000,000 installation is almost completely self-sufficient, generating all the power and producing nearly all the fuel required for its operation.

The plant includes grit removal tanks, preaeration tanks, primary settling tanks, and secondary treatment facilities for high rate activated sludge. These units remove approximately 80 per cent of the B.O.D. and of the suspended solids from the sewage. These solids, which amount to about 600,000 pounds per day, dry weight, are digested, dewatered and dried. The end product is disposed of as a fertilizer or soil conditioner.

Industrial Waste Treatment

Pratt & Whitney, a branch of United Aircraft at East Hartford, Conn., tackled its waste treatment problems in a most efficient manner. The wastes are plating and pickling liquors and spent oils. Treatment facilities provide for neutralization of acid wastes, alkaline-chlorination of cyanide liquors, reduction of chrome wastes with sulfur dioxide, and units for removal of soluble and mineral oils.

Another example of the way industry is proceeding on its own when feasible is that at one of the General Motors plants in Cleveland. The plant provides its own waste treatment and disposal because the City of Cleveland could not receive the waste in the city sewers even if treated. The treatment plant was designed on the basis of requirements issued by the Ohio State Department of Health. Filtration, chlorination, and aeration were added to meet the requirements. As with Pratt & Whitney, treatment was most concerned with soluble cutting oil emulsions.

These instances are only two of many examples of the progress being made in the treatment of industrial wastes.

Yardley Plastics Co. Photo

Ohio State Univ.—Corrosion resistance inside and outside: a 1500-foot line of 4-inch plastic pipe installed by two workmen in one day

Pacific Flush Tank Co. Photo

Cleveland, Ohio—The Southerly treatment plant added six new 95 ft. hexagonal digesters during 1952

The Drive Ahead

During 1952, conferences of groups concerned with sewage and industrial waste treatment were increasingly well attended. More and more communities became aware of what was going on in the world of sewage and wastes treatment, and public awareness of needs was accentuated.

When the Federation of Sewage and Industrial Wastes Associations held its 25th anniversary meeting in October, Abel Wolman threw down the gauntlet to those professional men under 40 who could break down and rebuild outworn practices of the past. He urged simplification in sewage treatment technology and structure; he spoke of mechanical filtration and total sludge conservation as coming into their own. An indication of the age, the year, and the future, was the review by Charles Emerson of the Federation's growth from a few hundred members in eight associations to more than 5,500 active members in 37 groups in 1952. A growing emphasis on industrial waste problems, which in 1950 caused the federation to change its very name, was evident in the sessions.

The 1952 rate of progress must be increased in 1953 in order to answer old problems as well as the new ones which are sure to arise with the New Year. Future solutions of old and new problems will depend on research, planning, and the provision of more and better trained operators and administrators.

Frank Dolson

J. F. Schondelmeyer

Missouri Joint Meeting Photo Correction

In our December, 1952, issue we carried a report "Missouri Holds Joint Meeting of Water and Sewage Groups." Secretary Warren A. Kramer (Mo. State Dept. of Health) has called to our attention an error in labeling two photographs appearing in that report.

Cuts on pages 498 and 500—Messrs. Dolson and Schondelmeyer—should be reversed. Properly titled above, Mr. Dolson is distribution engineer, St. Louis County Water Co., St. Louis, Mo., and Mr. Schondelmeyer is sanitary engineer, Sedalia, Mo.

We regret the error and are pleased to make this correction.

Sewage Plant a Gift—Approved by Legal O.K.

A sewage disposal plant may not be "overly romantic, but it's very necessary."

With this observation the Pennsylvania State Supreme Court recently ruled against a group of Penn Township residents who looked and sniffed down their noses at a gift sewage plant.

The decision came as the last step in an argument which began in August of last year when the Sampson Land Company and two affiliated firms offered to build and give to Penn Township the sewage treatment and disposal plant. The firms were then constructing 309 one-family dwellings in a 150-acre tract.

Penn Township accepted the gift and agreed to operate the plant, but a group of property owners went into court to block the deal on the grounds that such a plant was a nuisance and, in addition, violated the community's zoning laws.

They appealed to the Supreme Court after Common Pleas Court dismissed the suit.

The opinion written by Justice Michael A. Musmanno, declared that such a plant is not odoriferous, is not a nuisance, that the transaction is perfectly legal, and that the community should be glad to get it.

SEWAGE WORKS PRACTICES

OPERATION • MAINTENANCE • MANAGEMENT

Streams and Sewage Treatment

The First of a Series

by DON E. BLOODGOOD, *Professor of Sanitary Engineering, Purdue University, Lafayette, Ind.*

WHEN one hears the word "pollution" he usually thinks of the contamination of a stream. Practically all pollution control laws in force in the world today are so written as to specifically state that the protection of streams is the objective of the law. I definitely consider that this appreciation of stream condition—recognized by all the laws—would so impress every sewage plant operator he never would lose sight of the fact that his foremost duty is the protection of the stream which will be considered polluted if his sewage treatment plant is not kept in operation at all times.

Natural Purification in Streams

Streams were Nature's first waste disposal plants and, like many of Nature's other workings, the streams have served well in their attempt to overcome the misbehaviors of man.

There has been a statement, making the rounds for years, that a stream will purify itself in twenty miles. Now, some streams will purify themselves in this distance, some will purify themselves in three or four miles and there are others that have not returned to their natural state after flowing one hundred miles. The distance required for recovery is dependent entirely upon the local situation, as determined by (1) how much sewage is discharged to the stream; (2) how much water is flowing in the stream; (3) what is the temperature of the water and the air; and (4) how turbulent is the stream.

In building sewage treatment plants man actually has taken a stream and confined it within a small area, in order to carry out under controlled conditions the same processes that take place in a stream receiving sewage.

ABOUT THE AUTHOR

Professor Don Bloodgood has accepted an assignment to prepare a number of articles covering the field of sewage works practices. *Streams and Sewage Treatment* is the first of the series. Each article is to be developed in the form of a short school lecture.

Our readers will find information about the writer, his background, and his interests, helpful in understanding what he has to say. Accordingly, for those readers who do not know Professor Bloodgood, we provide a thumbnail sketch of the author.

Don Bloodgood is a graduate of the University of Wisconsin School of Civil Engineering, where he specialized in Sanitary Engineering. He was employed for two and one half years in the Research and Control Laboratory of the Milwaukee Sewerage Commission. In 1929 Don went to Indianapolis to carry out research on the production of fertilizer from activated sludge. He became assistant superintendent in charge of sewage treatment and, in 1936, was made manager of the sewage disposal and garbage reduction plants.

In 1943 Don moved on to Purdue University—first as Associate Professor of Sanitary Engineering and, since 1947, as full Professor. At Purdue, he has directed an extensive research program that includes projects in sewage and industrial waste disposal. He organized, and served as chairman of the nationally known Purdue Industrial Waste Conferences.

Our author has long recognized that sewage treatment plant operators need—and want to have—a better understanding of their work in order to do a better job. To fill this need, he frequently assists in conducting operators' short schools in Indiana, Texas and Wisconsin. The present series of articles will add to a list of more than 50 technical papers which he has published, covering a wide range of topics in the field of sewage and industrial waste disposal.

First president of the Indiana Sewage Works Association, Don also has been president of the Central States Sewage and Industrial Wastes Association. He is a member of many national and state organizations, including the A.S.C.E., the A.W.W.A., and the National Society of Professional Engineers. He is now vice-chairman of the Indiana State Board of Health.

MATANUSKA RIVER, in Alaska—Where there are no works of man, and hence no man-made pollution

As an illustration: where raw sewage is discharged, into a stream, the first section of the stream below the outfall sewer serves as a grit chamber. It is not impossible to imagine that the bushes and fallen trees with their limbs extending into the stream serve as coarse screens, removing material similar to that taken out by modern screening equipment. Of course, all this work taking place in the stream is not accomplished as scientifically and efficiently as it is in the sewage treatment plant.

Immediately after the deposition of grit, the stream serves as a septic tank where the settleable solids are deposited on the bottom of the stream. The liquid portion of the sewage is carried on to the lower stretches where, after a fashion, it becomes aerated. Then the organisms growing on the stones and in suspension in the water act in a manner similar to trickling filter or activated sludge purification of sewage. The distance that must be devoted to the processes going on in the stream will be longer than in the modern sewage treatment plant, thereby requiring more area—just as a larger sewage treatment plant is necessary when there is more sewage to be treated.

Oxygen in Streams

In certain sections of the stream oxygen is important to support the aerobic processes being carried on. The oxygen must come from the dissolved oxygen originally in the water, or that which is added to the water as it flows down the stream bed. In pointing out these facts I had hoped to impress you with the importance of stream flow in the process of self-purification. Certainly it is necessary to know the quantity of water flowing in a stream in order to determine how much oxygen is available to satisfy whatever demand for oxygen there may be, whether it is a demand resulting from the discharge of raw sewage, primary treated sewage, or completely treated secondary effluent.

Stream Flow

It is sometimes possible to determine the flow in streams by measuring the depth of water flow over dams in the vicinity. One is not apt, however, to find such convenient places to obtain the flow of a stream.

A most satisfactory source from which to obtain information on stream flows is the U.S. Geological Survey which, in many states, has very complete records on the quantity of water flowing in streams. Furthermore, if the information is not presently being obtained and you wish to obtain it, I am sure that a very equitable arrangement can be made so that the U.S. Geological Survey office in your area can provide you with information on stream flows, elevation gauges, and tables. Then, after the necessary equipment installation, you will be able within a matter of minutes to determine the stream flow at a particular time. Stream flow information should always be obtained and considered prior to the discharge of any unusual amount of pollution. In particular, before by-passing any waste, thought should be given to the effect that such pollution will have on the stream.

Temperature of Streams

Now I have mentioned and briefly discussed the importance of stream flow upon the natural treatment of sewage by a stream. There is another factor which actually controls the rate of decomposition in the stream. This important factor is temperature. Microorganisms, such as bacteria, which decompose sewage in streams are greatly affected by temperature. When the temperature of the stream is warm (as in the late spring, summer, or early fall, the activity of the organisms is much greater than when the water is cooler. The temperature of a stream, in most instances, is regulated by the temperature of the atmosphere.

However, the stream temperature may be elevated considerably by the addition of warm industrial wastes, so that more rapid decomposition may possibly be experienced in

WABASH RIVER, in Indiana—A beautiful stream glorified by moonlight
Protection of stream quality is the foremost duty of a sewage treatment plant operator

months when the temperature of the air is considered cool.

In the Midwest, the temperatures of streams start to rise as soon as warm spring weather begins. By the first of June, the waters have usually warmed up to the point where discharged sewage is quickly acted upon by microorganisms. Then, if there is not enough flow in the stream to supply the extra oxygen needed by the step up in activity of organisms, there will be a complete depletion of the oxygen; the result usually being a stream that becomes an evident nuisance. It is apparent the quantity of sewage going to streams should be kept at a minimum during the warmer months of the year.

Changes in Sewage Plant Operation Affect the Stream

The condition of the stream should be foremost in the sewage plant operator's mind when he considers any unusual operation or plans seasonal changes in operation. Sometimes an operator is confronted with a maintenance problem which will require by-passing of sewage. The operator may think that this particular job of maintenance will require only that his treatment plant be out of service for, say, one day. He may consider that this one day's discharge of raw or partially treated sewage will not have a bad effect on the stream.

It is true that the discharge of untreated sewage, for just one day, cannot possibly be as bad as a continual daily discharge of a similar quantity of sewage, but the operator should remember that the sewage discharged over a one-day period of by-passing moves down the stream almost as a body. As the sewage moves along the stream, it will undergo the same natural purification process as if the by-passing were going on every day. This being true, the dissolved oxygen content of the water will decrease and may reach zero. When the dissolved oxygen content of a stream is zero, you can almost be certain that a nuisance will be created.

Even in cases of short period by-passing, fish may be killed and bad odors may be given off. You can see, therefore, that when the stream flow is relatively low and the temperature like that in the late spring, summer or early fall, the bypassing of sewage for one day may result in a nuisance. For a short time thereafter the condition of the stream will be almost as bad as if no sewage treatment plant were in operation most of the time.

Streams and Public Health

It might have been more appropriate to discuss at the very outset the relationship between stream pollution and public health. This was not done because it is my opinion that an understanding of the fundamental principles involved in stream behavior is essential, even before discussing what may be the most significant feature of pollution.

Untreated sewage discharged to a stream carries with it dangerous bacteria which, if taken into public water supplies, may result in the sickness or even death of people who consume the water. Those organisms found in sewage which cause sickness do not multiply in numbers after they get into the stream, but their rate of dying is not as rapid as might be hoped for. As a matter of fact, the organism which causes typhoid fever is believed to live longer in cold water than it does in warm water; thus, if a sewage treatment plant is built to protect the surface water supply of a downstream community, the by-passing of sewage in winter time could be more dangerous than by-passing in the summer time. Where the operation of a sewage treatment plant is an integral part of protecting water that can eventually be made into safe drinking water, it is essential that the sewage treatment plant operate without interruption.

Streams and Fish Life

There are people who think that the fish life of a stream is not important from the standpoint of public health. Those of you who have known about fish killings as a result of pollution do not have to be convinced that there is nothing like a few dead fish to bring the wrath of the Conservation people and the newspapers down on the heads of those responsible for stream pollution abatement.

It is not the acidity or alkalinity of sewage that kills fish when sew-

age is discharged into a stream. The fish are smothered because they cannot get enough oxygen from the water of the polluted stream. The shortage of oxygen occurs because the bacteria which are decomposing the sewage require oxygen and use that available to the detriment of the poor fish. In such instances the oxygen is being used by the bacteria faster than it can be replaced from the air. When the activity of the bacteria is not great, as in winter time, an amount of sewage discharged will not bring about the same bad effect as when discharged during the summer.

Algae in Streams

Many stream receiving sewage plant effluents appear to be clear and in good physical condition for a short distance below the point where the effluent is discharged. Then, quite suddenly, great quantities of microscopic green plants called algae may appear in the stream. The presence of algae is frequently considered to be associated with stagnant and offensive waters. This is not necessarily true; as a matter of fact, algae grow best in sewage effluents of the highest quality.

Green and blue algae growing on the effluent weirs of a sewage treatment plant indicate that the sewage has been almost completely decomposed. The algae are using decomposed materials as food, much the same as fertilizers are utilized by farm crops. Algae growths in a stream are significant in that they indicate the water is rich in plant food. Waters containing large numbers of floating algae cells are not, in most cases, particularly dangerous from the public health standpoint. However, water containing algae often is difficult to treat, even in modern water treatment plants; and the treated water may have offensive tastes. It can be concluded, however, that the presence of algae is not an indicator of gross pollution.

Sludge Banks in Streams

At times of heavy rainfall, or when shutting down the treatment plant to make repairs, sewage may be by-passed and discharged to the stream without treatment. When this is done, raw settleable solids are deposited on the bottom of the stream. The process is not unlike that carried out in a primary sedimentation tank, the settling compartment of an Imhoff tank, or a septic tank. Comparison of the section of a stream where settling takes place to an Imhoff tank or septic tank makes us realize that the solids deposited on the bed of the stream will sooner or later start to decompose. Septic decomposition results in the evolution of gas which rises up through the sludge into the water above. The gas carries with it some organic matter that is utilized by the bacteria in the upper water. As a result, the water above the sludge may become devoid of oxygen.

The activity of microorganisms decomposing sludge, like that of microorganisms decomposing sewage, is dependent upon temperature; the higher the temperature, the more rapid the decomposition. The sewage plant operator should appreciate that sewage solids deposited on the bottom of the stream during the winter may exert an oxygen repuirement on the stream during the summer, particularly if the sludge remains on the stream bottom for a considerable period. Delayed decomposition of the sludge bank may result in a serious problem to a sewage plant operator who attempts to operate his sewage treatment plant only during the warmer months of the year. The location of the sludge bank in a stream usually can be determined by observing gas bubbles breaking the surface of the water. The gas ordinarily consists of carbon dioxide and methane, as does the gas from Imhoff tanks or separate slude digestion tanks. At times, however, bubbles of gas observed breaking the surface of a stream may be oxygen, produced by the algae in a stream.

Dissolved Oxygen in Streams

The *dissolved oxygen* in the water of a stream is not that oxygen which composes the molecule of water (H_2O). The dissolved oxygen is present in much the same manner as is sugar dissolved in water. The amount of oxygen that can be dissolved in water actually is quite small, as only about eight or nine pounds of oxygen can be dissolved in a million pounds of water. Most sewages have a demand for from 100 to 200 pounds of oxygen per millions pounds of sewage.

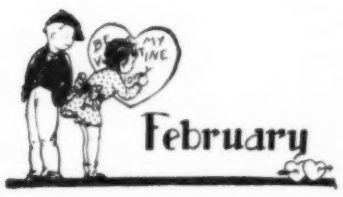
It can be seen that the presence or absence of dissolved oxygen in a stream is an indication of the requirement for oxygen by the sewage. If samples are taken in a flowing stream, say at one-half mile intervals, a set of data can be collected that will show the change in dissolved oxygen concentration as the sewage progresses downstream. When pollution enters a stream there will be a decrease in the dissolved oxygen concentration, until a point is reached in the stream where the demand for oxygen is less than the rate of oxygen getting into the water from the air. Where the rate of oxygen entering the stream is greater than the rate of oxygen usage, the stream condition will start to improve.

That point where the concentration of dissolved oxygen in the water is the lowest is called the critical point in the stream. This critical point usually is located within certain limits in a given stream. It moves up and down the stream, within the limited area, depending upon the velocity of flow and the temperature of the water.

Information regarding the effect of sewage or sewage effluents on a stream can be determined by periodic surveys. These surveys may entail expensive daily samplings with many chemical and bacteriological analyses, or they may only require the collection of samples once monthly with one test such as that for dissolved oxygen being made.

Pollution Control Laws—Their Basic Requirements

Regulations or laws designed to control the discharge of pollution, and to enforce the construction of sewage treatment plants, usually are so written as to require that a specific improvement be made in the quality of that stream or body of water receiving the pollution. This statement is presented to emphasize the importance of streams in relation to sewage works operation.



Jones Retirement and Blackburn Appointment in Pasadena, Calif.

The City of Pasadena, Calif., has announced the retirement of Morris S. Jones, long chief engineer and general manager of its water department. Mr. Jones has been a member of the AWWA since 1924, and a director since 1951.

Appointed to succeed Mr. Jones is Mr. Duncan A. Blackburn, who has been Asst. Chief Engr. of the department. Mr. Blackburn has been an AWWA member since 1941.

Senior Author

Slaughterhouse Waste Digestion*

Digester Design and Loading as Factors Which Determine Process Efficiency

by WILLEM RUDOLFS, *Former Chief, and* V. DEL QUERCIO, *Research Ass't., Dept. of Sanitation, Rutgers University, New Brunswick, N.J.*

SLAUGHTERHOUSE waste treatment, particularly digestion of waste, has not been the subject of the study it merits. Recently Fullen and Murphy[1] presented a paper at the Research Conference of the American Meat Institute dealing with anaerobic digestion of meat packing wastes. They reported that 90 to 95 per cent B.O.D. reduction could be obtained in one or two days digestion time, with removals of 0.1 lb. B.O.D. per cubic foot digestion capacity. Earlier experiments showed that slaughterhouse waste could be digested under mesophilic and thermophilic conditions in conjunction with sewage sludge, but that added blood wastes caused retardation and violent foaming during digestion, with high percentages of H_2S in the gas produced[2].

Experiments have been conducted over several years to determine the effect of mixing, agitation, method of charging to the digesters, type of tank, and loading on the digestion of slaughterhouse waste. It has been realized that for effective digestion of concentrated organic wastes intimate contact of the waste with the seed organisms is necessary. The quantities of waste applied and the possibility of short intervals or continuous feeding as compared with batch addition practiced in sewage sludge digestion are of considerable importance. Stirring and mixing of fresh sewage solids with ripe sludge has been recognized as a factor in digestion.

Effective digestion of slaughterhouse waste, particularly for smaller establishments, has great appeal if the process can be controlled readily and can produce good results without creating nuisances. The West Virginia Water Commission[3] concluded that a conventional type of treatment, including settling and standard rate or high-rate trickling filter units was required for all slaughterhouses handling 40 or more hog-units a day; whereas, use of a settling or septic tank followed by dry wells, subsurface disposal fields, filter trenches or filter beds was suggested for plants with less than 40-hog capacity.

Character of Wastes Used

Samples were collected from a slaughterhouse where, as usual, the animals are killed on the killing floor, hides and insides removed, carcasses trimmed, washed and dried, hides salted and stacked, and the blood from the killing floor drained into catch basins where it is stored until disposed of. The waste consists of blood, manure, flesh, fat particles, offal and other suspended matter contributed by the killing floor, carcass dressing, casings, and tripe wash rooms. The waste from the hide cellar is kept separate. The strength of the waste varies materially, but the general composition is: total solids between 3500 and 4500 ppm, B.O.D. 1000 to 2250 ppm, and total nitrogen 100 to 300 ppm.

Since the primary purpose of the studies was to determine the feasibility of treatment of the non-settleable and soluble materials and to observe the behavior of these materials during digestion, the wastes were settled to remove coarse particles. After preliminary experiments the wastes were mixed and diluted, if necessary, to an average strength of 1000 to 1800 ppm B.O.D.

I. Types of Digestion Tanks

Different methods of applying the waste may presumably result in different degrees of seeding, because of the intimacy of contact of waste and seed obtained under various conditions, which subsequently may affect the rate of digestion. The principle of "continuous upflow" digestion was applied and was compared with "daily batch" digestion used in normal sewage sludge digestion.

Five types of digesters, which could be left open or closed at the top, made feeding of raw or seeded waste possible. Sketches of the continuous up-flow digesters (Fig. 1) show the manner of operation.

In digester 1 (upflow disk distribution) the raw waste was fed through a pipe equipped with a solid disk around which the waste flow moved upward through a slotted metal plate to provide distribution of the waste through the seed sludge.

Digester 2 (upflow two-story) was essentially similar to digester 1, except that the distribution of the waste was through sludge retained in a separate compartment. For experimental purposes, the bottom was constructed in such a way that it could be moved upward to reduce the volume of sludge through which the waste passed and increase the surface area of the sludge. There is a relation between gas evolution, scum formation and surface area.

Digester 3 (upflow surface contact) was designed to distribute the waste as evenly as possible over the surface of the seed sludge, rather than to pass it through the sludge.

Digester 4 (upflow with stirring) was designed to provide maximum contact of the waste with sludge. The upward flow of waste passed through a stationary slatted distributor and the contents were mixed automatically for 2 minutes every hour with the aid of cup-like structures which helped lift the sludge. The result was that the sludge was thoroughly agitated at a very low speed, preventing sludge from disintegrating and passing out with the effluent.

Digester 5 was of standard design fed from the top, but waste was mixed with sludge and the unit was operated batch-wise.

The continuous feed and batch digesters received equal portions of

*Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, the State University of New Jersey, Department of Sanitation.

the same wastes. The continuous feed was applied for 8-hour periods every day with varying loadings.

Results of Investigations

The average characteristics of the raw wastes used for a set of experiments conducted over 26 consecutive days were as follows: B.O.D. 1975 ppm, volatile solids 2542 ppm, suspended solids 85 ppm, pH 7.2.

The average loadings applied every day were: B.O.D./cu.ft. digester capacity 0.62 lb., volatile solids 0.114 lb./lb. volatile solids in the seed sludge. These loadings correspond to 48 hours' detention of the waste in the digesters.

The average daily percentage B.O.D. reduction obtained is shown in Table 1. With the exception of

Table 1
PERCENTAGE B.O.D. REDUCTION
Average Per Day

No.	Digester	First 4 Days	26 Days
1	Surface contact	55.3	50.6
2	Upflow disk	87.8	88.2
3	Two-story	89.3	93.2
4	Stirring	90.0	92.8
5	Batch	89.3	92.2

the "surface contact" digester, the percentage B.O.D. reduction was uniformly high over the entire period of the experiments. The "surface contact" digester showed average B.O.D. reductions of 55.3 percent during the first 4 days, which gradually increased to 85 percent and then dropped to about 14 percent. The effluent was dark and very foul smelling in contrast to the other effluents. The mass became gradually inactive so far as gas production was concerned.

The similarity in the percentage B.O.D. reduction produced in the other four digesters indicated that the detention of 48 hours could probably be reduced; in other words, the loadings could be increased.

Increased B.O.D. Loadings

Experiments with similar volumes but increasing strengths of the waste showed that very good B.O.D. reduction could be obtained with increased B.O.D. loadings. This is indicated in the average results given in Table 2.

Usually, when industrial wastes are digested, some time is required

Table 2
EFFECT OF INCREASED B.O.D. LOADING ON PERCENTAGE B.O.D. REDUCTION

Waste B.O.D. (ppm)	lbs./B.O.D. cu. ft./day	Batch Mixing	Upflow two-story	Upflow Stirring
1335	0.042	89.3	—	90.0
2175	0.068	91.1	91.0	92.0
3640	0.114	92.8	93.8	91.6

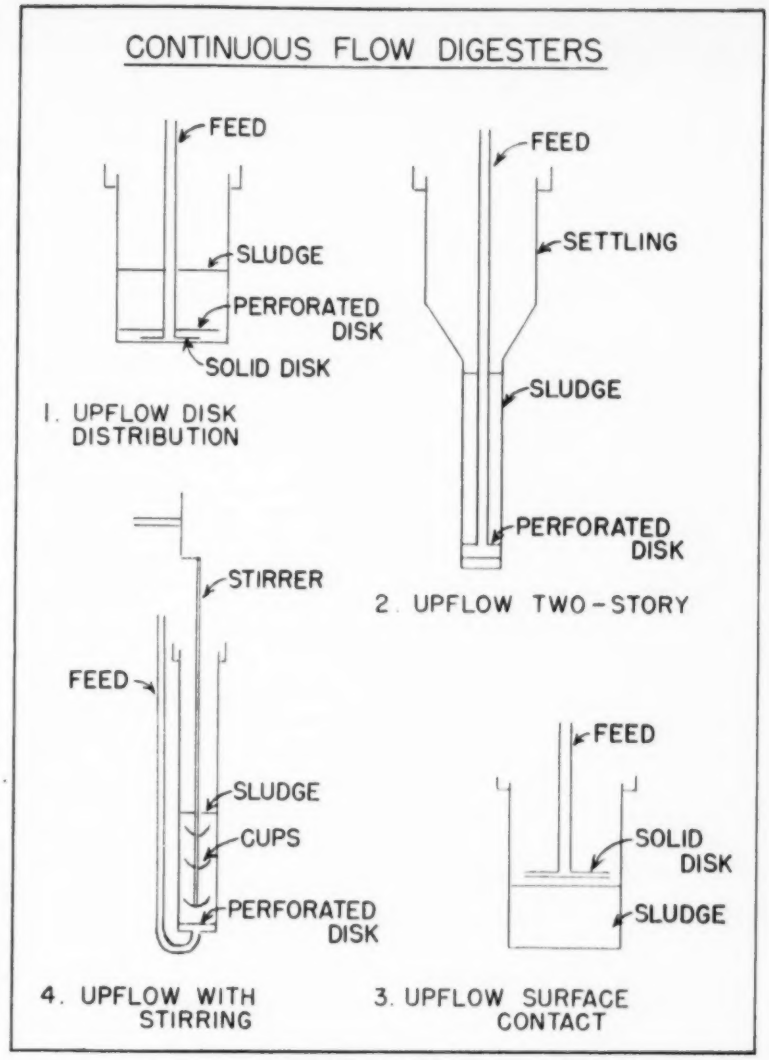


Fig. 1—ARRANGEMENT of the four types of digesters

for the seed sludge to be acclimatized by a gradual increase in the loading. It is of particular interest that with the slaughterhouse waste (Table 2) only 3 days were allowed to elapse before B.O.D. determinations were made of the effluents, indicating the rapid adjustment of the seed sludge to the increased loadings. However, the loadings in all cases were relatively low.

Distribution and Mixing Effect

The manner of distribution of the waste and the degree of mixing affect the turbidity of the effluent to a greater degree than the percentage B.O.D. reduction. This is shown by the following average figures of the turbidity in the effluents:

Batch—mixing	41 ppm
Upflow—two story	118 ppm
Upflow—mechanical stirring	190 ppm

In the digestion of soluble organic wastes the organisms responsible are concentrated in the sludge and must have access to the food. If the waste is mixed with the sludge during feeding, biological activities are stimulated and the gas produced may carry sludge particles for further distribution. Upflow digesters provide contact between the organic material and the sludge by passing the waste slowly through the sludge; and they provide proper distribution of the food for the organisms.

The contact provided by the different methods of waste distribution appeared to be sufficient for effective B.O.D. reduction, but because of the relatively low loadings, requiring detention periods of 48 hours, neither the best method of distribution nor the minimum detention period was established.

Table 3
AVERAGE COMPOSITION OF WASTE, AND DAILY LOADINGS

	7 Hours Feed	20 Hours Feed
B.O.D., ppm	1363	1315
Total Solids, ppm	1819	1538
Vol. Solids, ppm	1538	1550
Susp. Solids, ppm	82	61
Detention, Days	1.54	1.54
Loadings, lbs./B.O.D./lb. of V.S. in sludge	0.126	0.122
Loadings, lbs. V.S./lb. of V.S. in sludge	0.142	0.143

Summary

Experiments made to determine the effect of adding and mixing slaughterhouse waste to continuous flow anaerobic digesters showed that intimate mixing of the soluble waste with the seed sludge is necessary for effective digestion. The several types of tanks used indicate that upflow of the waste through the sludge blanket, upflow plus stirring, and rapid initial mixing of the waste with the sludge gave almost equally good results with relatively low loadings. Violent stirring or short circuiting of waste through the sludge is detrimental and produces a poorer effluent. With detention periods of 48 hours and loadings of 0.114 lb./cu. ft. digester capacity per day, over 90 percent B.O.D. reduction can be obtained.

II. Loading of Digesters

A subsequent study was made to determine the effect of feeding rates on the anaerobic digestion of slaughterhouse wastes. Three of the digesters previously described, namely, upflow two-story, upflow mechanical stirring, and batch mixing, were used.

Daily additions of waste were made to acclimatized sludge. The volumes of wastes were in proportion of 3 to 1 of the sludge. In the continuous upflow tanks the wastes were added daily over periods of 7 and 20 hours. These feeding periods were chosen on the supposition that, in actual plant operation, the waste could be collected during the working days and discharged during a period of 7 hours, or stored and discharged over a period of 20 hours so that the storage basin would be empty on the following day.

Analyses of Waste

Analyses were made daily from samples of the first and last two-hour portions of the effluent from the continuous overflow, allowing one hour settling; and from the tanks receiving daily batches samples were taken at the end of 24 hours detention. The seed sludges averaged 5.57 percent total solids and 58.4 percent volatile solids. The temperature of digestion was about 83-85°F.

The average composition of the raw waste added daily over 7 and 20 hour periods was approximately the same (Table 3) and the loadings, expressed in pounds B.O.D. and volatile solids per pound of volatile solids in the seed sludge, were comparable.

Rate of Feeding Effects

A comparison of the average daily B.O.D. reductions obtained with the three digesters is given in Table 4. It is evident that feeding a quantity of waste over a period of 7 hours produces poorer results than the feeding of the same quantity of waste over a period of 20 hours. In continuous feeding of a constant amount of waste the average contact time with the sludge is actually only half of the feeding period, e.g., about 4 or 10 hours: in view of this, the results show very good percentage B.O.D. reductions. It is clear, however, that feeding of the same amount of waste over a longer period during the day is preferable to shorter feeding periods or batch additions.

Table 4
AVERAGE DAILY B.O.D. REDUCTION

	7 Hrs. Feed	20 Hrs. Feed
Upflow two-story	84.8	95.4
Upflow stirring	86.3	96.9
Batch mixing	92.3	92.8

Continuous feeding over a shorter period requires settling of the effluent to remove suspended solids and allow return of the seed to the digesters. Without return of the settled solids the tank becomes depleted of seed. This is clearly shown by the average turbidity results obtained:

	7 hrs. feed	20 hrs. feed
Upflow two-story	90 ppm	31 ppm
Upflow stirring	100 ppm	34 ppm
Batch mixing	—	27 ppm

The average gas production amounted to 8.06 cu. ft. per lb. of volatile solids added. Feeding of the waste over a shorter or longer period made no material difference. This volume of gas is about the same as that obtained from other nitrogenous wastes. The gas yield of yeast waste has been reported[4] to be 7.5 cu. ft. per lb. of volatile matter added, with 90 percent B.O.D. reduction. Buswell and Hatfield[5] obtained from well digested packing house screenings 6.4 cu. ft. of gas per lb. of volatile matter added; whereas Fuller and Murphy[1] report gas production varying from 6.7 to 10.5 cu. ft. per lb. volatile solids added, depending upon the digester loadings.

Table 5
EFFECT OF INCREASED VOLUME LOADING ON B.O.D. REDUCTION

	Upflow Two-Story	Upflow Mechanical Mixing	Batch Mixing
Loading lbs. B.O.D./lb. sludge Vol. Sol.	0.179	0.204	0.191
Loading lbs. Vol. Sol./lb. sludge V.S.	0.247	0.266	0.229
B.O.D. red. %, 7 hrs. feed	73.4	76.6	61.0
B.O.D. red. %, 22 hrs. feed	82.9	83.5	63.2
Susp. Solids effl., ppm, 7 hrs.	84	77	—
Susp. Solids effl., ppm 24 hrs.	37	58	54

In general, it appears that a slower feed rate results in better digestion and less carry-over of sludge, and that detention times of 1.54 days were rather long in view of the rapidity of digestion.

Volume Loading Effects

Increasing the digester loadings by increasing the concentration of the waste (within the limits of the raw waste obtainable), and decreasing the detention time 25 percent did not impair the B.O.D. reduction. In the same digesters, waste volume to sludge volume loadings were increased from 3 to 1 up to 4.5 to 1; the wastes were added over 7 and 22 hour periods.

The acclimatized seed sludges contained 5.17 percent total solids, of which 61.1 percent were volatile. The average daily B.O.D. and volatile solids content of the added wastes varied from 1272 to 1450 ppm and 1606 to 1967 ppm, respectively. The digestion temperature was 75-76°F. At the higher volume loadings and lower digestion temperatures, differences between the types of digesters should be accentuated.

The average daily loadings and percentages B.O.D. reductions (Table 5) show that by raising the volume loadings and reducing the quantities of seed sludge the B.O.D. and volatile solids loadings were increased. Under these conditions, the upflow two-story and upflow mechanical mixing tanks produced practically the same percentage B.O.D. reduction, but with the same amount of waste added over a 22 hour period as compared with a 7 hour period the longer feed period produced materially better results. The batch mixing tank produced nearly 20 percent lower B.O.D. reduction than the upflow tanks. Gas production for the batch mixing tank was only 4.8 cu. ft. per lb. volatile solids added.

Table 6
EFFECT OF CONTINUOUS AND INTERMITTENT FEED

Digester	% B.O.D. Reduction
Upflow-continuous feed	83.5
Upflow-stirring continuous	82.9
Feeding and mixing 4 times daily	75.5
Feeding and mixing once a day	61.0

Intermittent Feed Effect

Intimate contact of the bacteria in the seed with the food applied is important. It can be accomplished by continuous waste flow through the sludge, by stirring continuously or intermittently the sludge receiving a given volume of waste continuously, or by adding wastes intermittenly and mixing at the time of addition of the waste. In a series of experiments, wastes were added continuously, were added four times a day, and were added once a day to different digesters; 4 to 5 volumes of waste were used with one volume of sludge. The average daily B.O.D. and volatile solids loadings were: 0.179 lb. B.O.D. and 0.247 lb. volatile solids per lb. of volatile solids a day.

The effect of continuous flow and intermittent mixing is illustrated by the percentages B.O.D. reduction shown in Table 6. It appears that charging the digesters four times daily, compared with the same total loading as applied once a day in a single charge, increases the degree of B.O.D. reduction, but is not so effective as continuous flow charges. Again, continuous upflow supplemented by stirring does not appear to enhance the B.O.D. reduction.

The effect of intermittent charging on total gas production is negligible. This is illustrated by the following figures showing the cu. ft. of gas produced per lb. of volatile solids added:

Charging	Gas Produced cu. ft./lb. volatile solids
Once daily	5.10
Twice daily	4.84
Four times daily	4.92

From 70 to 75 percent of the total gas was produced during the first 12 hours after charging, no matter whether the intervals of charging were short or long.

Open and Closed Digesters

Slaughterhouses and small packing plants conceivably might not be interested in gas production. Moreover, to simplify the construction of digesters, heating may not be provided. Laboratory and plant scale experiments with sewage sludge have shown that digestion proceeds at about the same rate in open and closed tanks. Experiments with slaughterhouse wastes (B.O.D. values of 1250 to 1320 ppm and total solids of 3135 to 3145 ppm) were made in 3 closed and 3 open digesters receiving different loadings. The digesters were kept at a temperature of about 70°F. The detention times and loadings were as follows:

Volume Loading Sludge-Waste	B.O.D. lb./cu. ft./day	Detention Days
1:1	0.035	2.28
1:2	0.047	1.71
1:3	0.054	1.51

Seed sludge was acclimatized for a month by gradually increasing the quantities of wastes added. The condensed results of daily B.O.D. and volatile solids reduction are shown in Table 7. From these results it is clear that, at the lower temperature, the loadings must be materially reduced and the detention time must be increased to about 2.25 days in order to obtain an 80 percent B.O.D. reduction (as compared with the same reduction obtained in about one day at 85-90°F). The B.O.D. and volatile matter reduction was somewhat higher in the open than in the closed digesters. As in other types of organic wastes digestion, the percentage B.O.D. and volatile solids reduction can be readily controlled by the loadings, whether the tanks are open or closed.

Table 7
AVERAGE B.O.D. AND VOLATILE SOLIDS REDUCTION, OPEN AND CLOSED DIGESTERS

	Open			Closed		
Loading lb./cu. ft./day	0.047	0.054	0.035	0.047	0.054
B.O.D. Red.,%	70.9	51.6	81.0	66.4	43.8
Vol. Sol. Red., %	51.2	44.7	57.7	45.9	42.8
Gas, cu. ft./lb. Vol. Mat.	—	—	4.39	3.25	2.21

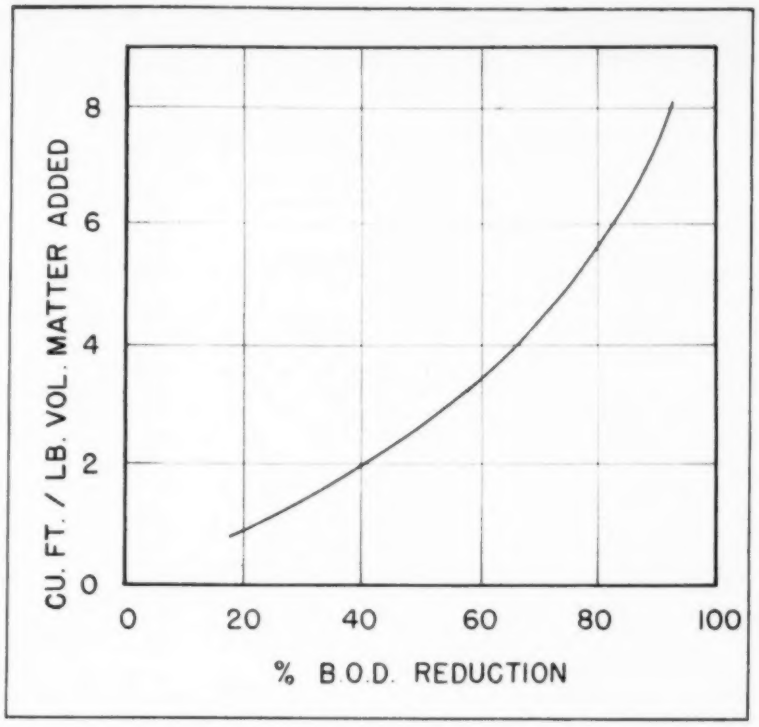


Fig. 2—B.O.D. reduction related to gas production

Table 8
LOADINGS AND REDUCTIONS AT 70° F.

Volume Loading	1:2.5	1:5	1:10
B.O.D. Loading, lb./cu. ft./day	0.078	0.098	0.120
Detention, days	1.1	0.8	0.65
B.O.D. Red., %	79.5	44.5	19.0
Vol. Sol. Red., %	82.5	76.4	48.6
Gas Prod., cu. ft./lb. Vol. Sol.	5.37	2.61	0.85

Lower Temperature and Maximum Loading

It was previously found that charging digesters twice daily was about as effective as charging four times a day. Charging twice daily would allow samples to be taken and analyses to be made every 12 hours. Experiments were made using three closed digesters supplied with acclimatized sludge and kept at a digestion temperature of about 70°F. These were charged twice daily with waste having an average B.O.D. of 1586 ppm, and an average of 1782 ppm volatile solids.

The daily average loadings and B.O.D. and volatile solids reductions are shown in Table 8. In order to obtain about 80 percent B.O.D. re-

duction at the lower temperature, the B.O.D. loading cannot exceed 0.078 lbs./cu. ft. digester capacity per day with volume loadings of 2.5 times the quantity of sludge. However, this loading is materially higher than can be obtained by charging the digester with a similar quantity of waste only once a day. High volume loadings reduce the detention time to such a degree that B.O.D. reduction is greatly impaired. Obviously, both B.O.D. and volume loading must be considered.

Gas Production

The volume of gas produced is naturally related to the B.O.D. or volatile matter reduction accomplished. However, there is no direct relationship (Fig. 2). For instance, about half the amount of gas is produced with a B.O.D. reduction of 70 percent, as is produced with a B.O.D. reduction of 92.5 percent. This is in accordance with the concept that organic matter in process of anaerobic decomposition may exert a higher 5-day B.O.D. per unit weight than the original or stabilized material. The more complete the stabilization of the organic matter, the greater the quantities of gas produced. Nevertheless, the quantities of gas produced can be used only as a rough measuring stick of 5-day B.O.D. reduction and cannot be used to determine the actual percentage B.O.D. reduction.

The gas produced from sewage solids digested under proper conditions normally contains about 20 percent CO_2. The gas produced from slaughterhouse waste digestion contained from 4 to 7.5 percent CO_2 and consequently had considerably higher heat values. The reason for the lower carbon dioxide content in the slaughterhouse gas probably is that larger amounts of CO_2 are held by the alkaline nitrogenous decomposition products of the waste. The conversion of the CO_2 into ammonium carbonates results in an apparent lower total gas production per pound volatile matter added, but not necessarily in a lower total BTU value.

Discussion

In order that the organisms responsible for digestion may carry out their proper functions, the necessary food supply must constantly be made available. It is essential, therefore, that the waste be adequately mixed or properly distributed through the seed sludge.

Distribution of the waste may be accomplished by natural means such as gas evolution, but the rate of digestion can be enhanced either through mixing by mechanical methods of through providing proper distribution of the waste in the inoculum. Continuous mechanical mixing of large volumes of soluble organic wastes with sludge continuously may lead to excessive sludge expansion (with subsequent loss of sludge) and turbidity of the effluent. Various methods of mixing are possible.

To reduce loss of seed sludge, waste may be added and mixed for a short period several times a day or by a continuous upflow method. In continuous upflow methods, it is better to feed the waste over a 24 hour period rather than during a working day of 7 to 8 hours. In upflow digesters, the degree of purification can be regulated to obtain 95 percent or more B.O.D. reduction by variation of the load applied. Feeding the waste through a series of slowly rotating nozzles near the bottom of the digester insures even waste distribution and good contact with the sludge.

When gas is not to be utilized, open upflow digestion tanks will perform as well as closed digesters; but nuisances caused by odors, flies, and maggots should be considered.

Slaughterhouse wastes having B.O.D. values of 1500 to 1800 ppm may be treated to obtain 90 to 95 percent B.O.D. reductions. At digestion temperatures of 70, 85, and 95°F., this can be accomplished by providing corresponding detention periods of 2.25, 1.6, and 1.1 days.

Summary

Digestion of slaughterhouse waste can be accomplished to any desired degree in upflow digesters by controlling the rate of feeding. B.O.D. reductions of 95 to 98 percent are readily attainable with relatively low loadings. Both volume and B.O.D. loadings must be considered for best results. About one month should be allowed to acclimatize the inoculum for optimum performance. Drastic mixing may result in deterioration of the effluent and loss of seed sludge. Acclimatized seed sludge withstands shock loads without difficulty. Upflow digesters produce better results than "batch" digesters.

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"Plastic Camels" for Water Transportation Across Desert

Possible Forerunner of Plastic Elevated Tanks?

The Standard Oil Co. has a fleet of "Plastic Camels" transporting water through the desert to the plant of the Arabian-American Oil Co.

The "Plastic Camels," as they are called by "Aramco," are the new tank-wagons on which the tank is made of plastic instead of metal. The oil company is also adopting plastic for its fleet of oil tank wagons. Reason given is that less dead weight has to be moved in transporting oil and water. More importantly, the company has solved the corrosion problem. And, considerably less maintenance work and expense is entailed in operating the tank-truck fleets—oil and water.

This development makes one wonder if before too long some of our elevated tanks will not be constructed of a suitable plastic, putting an end to the problems of painting and maintenance.

Color of Fire Hydrant Shows Size of Main

The city of Wisconsin Rapids, Wis., has adopted a system of painting its fire hydrants so firemen can tell at a glance how much water to expect from the water main.

The color of the paint shows the size of the main. The colors red, white and blue painted on the hydrant cap denote 4-, 6- and 8-inch mains respectively. Hydrants painted all yellow are connected to 10-inch mains, green hydrants indicate 12-inch mains.

"HEY, POP! I THINK I FOUND THE PIPE WE BEEN LOOKING FOR."

Cost-Control as a Tool for Building Net Revenue

by W. VICTOR WEIR, *President & Genl. Mgr., St. Louis County Water Co. Univ. City, St. Louis, Mo.*

THE management tool—Cost Control—has been developed and utilized extensively by competitive industry to accomplish two things: first, to enable the establishment of prices which must be charged for the articles they would produce and sell; second, to enable management to watch the costs of production so that the costs of the finished products will be less than the prices at which the goods must be sold in competitive markets.

The water works industry has been slow in adopting cost control as an ordinary management tool, principally because the element of competition is lacking. Other public utility services also usually operate as monopolies, but they have adopted cost control to a greater extent than has the water works industry because they do experience the element of competition. These are the electric, gas and transportation utilities. Their products and services are definitely in a competitive field.

Definitions

In discussing "Cost Control," we should define the term. Cost control is achievement of minimum operating costs and resultant maximum net revenues or profits which result through management's obtaining, considering, and acting upon cost analyses.

Since "cost accounting" is an essential element of cost control we should define that term. The manual of water works accounting issued by the Municipal Finance Officers Association and the American Water Works Association defines cost accounting as "That method of accounting which provides for the assembling and recording of all elements of cost incurred to accomplish a purpose, to carry on an activity or operation, or to complete a unit of work or a specific job."

Cost Control Procedure

Cost control has three primary elements, all of which must be carried through to completion if full benefits are to be obtained.

1. Management must set up the tools it needs, principally general accounting and cost accounting systems. While most utilities do have general accounting systems, the practice of cost control may require modifications so that management may obtain the accounting information it needs. Cost accounting practices utilize much data assembled in general accounting, in addition to the specialized accounting procedures required.

2. Management must review, on as current a basis as possible, the accounting and cost information reported to it.

3. Management must act to improve the personnel, the organization, the operating facilities, and the operating practices, as indicated by its analyses of the cost information.

This paper was presented by Mr. Weir before the Illinois Short Course for Water Works Management conducted by the Business Management Service and the Extension Division of the Univ. of Illinois and sponsored by the Illinois Section of A.W.W.A. It is being printed in *Water & Sewage Works* by permission of the author and approval of the Univ. of Illinois and the A.W.W.A.

Accounting Procedures in Cost Control

(1)—*General Accounting — Operating Information.*

Proper general accounting practices will produce, or should be made to produce, information covering (a) Revenues—(b) Operating expenses—(c) Maintenance expenses—(d) Depreciation expenses—(e) Taxes—(f) Interest and other income deductions—(g) Net income. Certain other information, depending upon the specific utility involved, will also be produced. The categories listed above are only the primary ones.

(2)—*General Accounting—Property Information.*

Good general accounting practices will produce monthly and annual information concerning the costs of property additions and retirements by property classification. Inasmuch as installation of property causes certain expenses generally termed as "overheads," the general accounting practices will develop the overhead charges which should be made to the various property accounts.

(3)—*Customer Accounting and Collecting.*

While accounting information of this type may not appear to be essential in the practice of cost control, it is valuable to management since it must know where the product is going, the percentage being delivered to various types of customers, whether their payments for the product and service compensate for the costs involved and whether the amounts owed are being collected. The basic data required are:

(a) Sales, by customer classification.

(b) Revenue, by customer classification.

(c) Collections and delinquencies.

(4)—*Expenditure Accountings.*

Accounting, in this category, is generally in addition to general accounting. The activities involved cover:

PURCHASING: All utilities follow purchasing practices which range from well organized to chaotic. A satisfactory purchasing procedure calls for the organization of the steps involved, and the institution of control where necessary, to meet the needs of each specific utility operation. Variations are dependent upon the size of the utility and whether or not utility purchases are combined in any manner with other departmental or utility activities.

STORES — MATERIALS AND SUPPLIES: Water works materials and supplies are used for operations, maintenance, or the construction of

new facilities. Expenditures on such materials and supplies must be properly accounted for, to enable charges to be made to the specific operations or jobs involved. Internal organization and control is necessary, not only to show the use of, but to prevent the loss of, any materials.

CONTRACTUAL SERVICES: Water utilities incur expenses for services or equipment provided by outsiders. These items include construction by contract, rent, insurance, transportation services, telephone, postage. Inasmuch as these expenditures are often large in a utility's total expenditures, the accounting procedures should record such expenses in reasonable detail, and by categories.

EQUIPMENT: Cost data must be kept covering the principal individual pieces of equipment, such as transportation units, heavy construction machinery, and costly office equipment, such as billing machines, to enable management to determine when such items should be replaced. Equipment costs of smaller items, such as meters, may be kept by groups of similar units.

PAYROLL: A large part of utility total expenditures consist of payrolls for wages and salaries. Since the work involved covers both operations and construction, expenditures in the form of wages and salaries must be properly allocated. In addition to the dollars involved, summary data concerning number of employees, hours of work, etc., must be kept if management is to use payroll information to gauge the efficiency of operations.

(5)—*Cost Accounting.*

The accounting data and the statistical data must be further developed to produce, first, the suitable units which will be used for each classification of operation and property which is to be subject to cost control, and second, the development of the cost of these units of performance or property. A work order system must be followed to allow the identification of costs chargeable to individual jobs or projects.

(6)—*Reports.*

Management, to exercise cost control, must receive periodic reports of the various items involved. These reports are made daily, weekly, monthly and annually, depending upon the fluctuations in pumpage and sales, the employees work load, and the need for making changes in operating and construction schedules and practices. These reports will generally be prepared by the persons handling general and cost accounting work, although in small utilities they may have to be prepared by management personnel. These reports are:

(a) Financial Reports,—operating, maintenance and property.

(b) Statistical Reports,—tabulations and graphs, depending upon the most satisfactory manner to show the statistics involved.

(c) Performance Reports,—covering operations and installation of property additions.

Aims of Cost Control

Management's use of cost control allows:

(1) The measurement of work loads of employees and groups of employees.

(2) The determination of efficiency of employees, equipment, and practices.

(3) The measurement of the capability of employees and equipment to meet potential demands for water and service.

(4) Steps toward the economical expansion of facilities to handle growth.

(5) Budgeting for future expansion and construction.

The application of accounting and other information used in cost control is generally the comparison of present with past comparable unit costs, and the comparison of unit costs with comparable unit costs being experienced by other utilities. The latter is only possible where standard units and standard accounting practices are used by the utilities being compared. This may be done where utilities follow standard accounting procedures, such as that recommended by the National Association of Railroad and Utility Commissioners, which has been adopted by many Public Service Commissions for use by privately owned and operated utilities. Municipally operated utilities that have adopted this standard classification of accounts may also be able to make comparisons of unit operating and construction costs.

Unit Costs Derived Through Cost Accounting

In the category of operating and maintenance expenses the following unit costs are desirable:

(a) Operating expenses by classification, per thousand or million gallons pumped and per average customer supplied, for the current month and for the elapsed period in the current year, with comparable figures for the same period of the previous year or years.

(b) Maintenance expenses by property classification, i.e., pumping and purification maintenance expenses per thousand or million gallons pumped; for mains per mile in service; for services per unit; for meters per unit; for fire hydrants per unit.

Unit costs of property items, subdivided as to material, labor contractural services, overheads, etc. are desirable for the installation of:

(a) Water mains, per foot for each size.

(b) Services, per unit and per foot for each size.

(c) Meters, per unit per each size.

(d) Hydrants, per unit per each size.

Statistical reports are necessary covering, but not limited to, the following:

(a) Customers, monthly increase and cumulative number.

(b) Water pumped, monthly and cumulative for year.

(c) Water used in company operations, at plant, meter department, and for construction purposes, monthly and cumulative for year.

(d) Water sold, monthly and cumulative for year, with reasonable estimates being made where water sales are unmetered.

(e) Ratio of water sold to net water delivered to the distribution system, which ratio should also be considered as percent accounted for.

(f) Fuel or power used, monthly and cumulative, by operating classifications.

(g) Cost of fuel or power used by each operating classification and per million gallons pumped in each operating classification.

(h) Chemicals used, in pounds, by name of each.

(i) Cost of chemicals, classified by units of each chemical and per million gallons produced.

Practices Subject to Cost Control

The application by management of proper cost control procedures will allow conclusions to be reached and decisions to be made concerning installations of the following:

Property Classifications

(a) Selection of kind of power to be used for pumping: steam, diesel, gas, gasoline, or electric, produced or purchased.

(b) Determination of desirable sizes of plant units and facilities.

(c) Selection of materials for and sizes of water mains.

(d) Selection of method of installation of facilities, i.e., force account or contract.

(e) Selection of equipment of various kinds.

(f) Comparison of alternate facilities, such as distribution storage,

versus transmission mains, versus booster pumps; and elevated storage, versus surface storage.

Operating Practices

The following operating practices lend themselves to cost control.

(a) Establishment of plant operating schedules, which may be affected by personnel costs, purification costs, pumping costs, and changing demands placed upon the system by customer use.

(b) Selection between optional power rate schedules, which may carry varying demand and energy charges, to obtain the lowest power costs to handle the pumping schedule required to meet customer demands.

(c) Meter repair practices, particularly as to the economics of repairing or replacing meters.

(d) Determination of efficiency of personnel, particularly as to work load of individuals and groups, and the desirability of shifting employees between work classifications when work load changes occur.

(e) Determination of efficiency of equipment to give information as to need for maintenance or replacement.

Difficulties Encountered in Cost Control

An element in the comparatively small use of cost control in the water supply industry is that water works managements are often comprised of persons who do not have too much sympathy for and do not understand the benefits which can be obtained from proper and more complete accounting information.

Management too often thinks it is, or actually may be, too busy to spend time studying accounting data.

Management does not realize the value of the expenditures made on accounting procedures having only indirect value. Too often the tendency is to go to less rather than more accounting information, the result being that the accounting information produced is of little value in operating a utility property.

Employees are reluctant to perform the paper work involved in accounting and cost control. They are more interested in work where the accomplishments are evident. Constant pressure must be put upon employees to promptly and accurately report all work done.

The accounting reports may be made too late to be of maximum value. As stated, in some instances daily and weekly reports are needed. For practically all operations monthly summaries should be made. Annual reports are of minor importance in cost control, inasmuch as they are reporting ancient history by the time they are developed.

Recommendations

(a) Compare the accounting practices of your utility with recommended standards. Particularly compare the cost accounting and expenditure accounting procedures with those you know are good. Your outside accountants may help with this. The Manual of Water Works Accounting, previously mentioned, covers these subjects excellently.

(b) Determine what cost information you wish to keep, and set up a system to produce those costs. Start modestly.

(c) Check the various records being kept and reports being made to determine whether the desired unit costs can be obtained. At the same time determine whether certain records being kept are actually useless and should be eliminated.

(d) Supply cost information to all water works personnel who can assist in controlling costs. The efficiency of operations, including theirs, is measurable by costs of performance. Some records, such as automobile costs, should be posted for all to see.

(e) Keep cost information on a current basis. Old records are only good for comparisons with current data.

(f) Decide to spend enough time on cost control that it may become a good management tool to the end that expenses may be reduced and net income increased.

California Industry Cooperates in Anti-pollution Program

Derby Says Long-range Plans Will Include Reclamation of Waste Water

Representatives of California's industry have pledged their support of the state-wide program to maintain purity of water supplies. The entire vital problem of water was discussed at a recent meeting in Los Angeles sponsored by the California Manufacturers Association at which representatives of industry and the State Water Pollution Control Board expressed their views on the matter.

Gen. Warren T. Hannum, who is chairman of the State board and State Director of Natural Resources, told the meeting that California's water pollution law, which has been in effect for less than three years, appeared to be a complete success.

He said the State board had yet to receive a single appeal from the State's nine regional boards, which are composed of representatives of agriculture, industry, counties, municipalities and water distributors.

"The sole objective of this law," said Gen. Hannum, "is to assure the maximum beneficial use of the State's waters. Top priority for the use of water is for domestic purposes and agriculture."

Gen. Hannum spoke of the complete co-operation the State and its regional boards have received from industry "because the law provides for co-operative administration as contrasted with the more common practice of control through police power."

Water Reuse Considered

Ray L. Derby, chairman of the Los Angeles Regional Water Pollution Control Board, discussed the problem of water pollution in his areas and said that long-range plans for the building of reclamation stations for the reuse of waste water should be considered.

"We are talking now," he said, "of bringing Feather River water to Los Angeles at an estimated cost of as much as $35 an acre-foot. Yet some experts believe that water can be reclaimed at a much cheaper figure from waste water here."

He declared that it is conceivable that special industrial sewers could be constructed to carry away from industrial processes waste water polluted beyond reclaiming.

Shephard Succeeds Hepler in Mich. Health Dept.

Willard F. Shephard has become Director of the Division of Engineering, Michigan Dept. of Health, succeeding John Hepler, recently resigned. Mr. Hepler resigned to become Chief Sanitary Engineer with the Institute of Inter-American affairs in Santiago, Chile; he had been with the Michigan Dept. of Health for nearly 34 years. Mr. Shephard has served with the department since 1920, the last several years as Chief of the Section of Sewerage and Sewage Disposal.

Fluoridation Experiences in a Small Water Plant

Brookville, Pa., Finds This Treatment Simple to Operate and Control

by R. P. FERRINGER, *Plant Supt., Borough Water Dept. Brookville, Pa.*

BROOKVILLE'S fluoridation program was one year old in September, 1952. From the time fluoridation of the local water supply was first considered until the present time, no public opposition has been voiced by any groups or individual. The action of the Borough Council was construed as being a mandate of the majority of the people and no referendum vote was considered.

Water department personnel maintained a neutral attitude concerning the anticipated benefits to be expected from the fluoridation of the water supply. Requests to speak before a number of the local civic groups were accepted. Every effort was made to present facts and not opinions. It was found advisable to explain from the beginning what 1.0 ppm actually means. Much of the material presented was taken from technical and professional publications, including reports of the National Research Council and those published by state and national health agencies.

Fluoridation permit procedure followed that required by the Pennsylvania Department of Health. Upon approval of the permit, the necessary equipment and supplies were ordered. The dry feed machine was installed by plant personnel.

Equipment Installation

The equipment selected includes a Wallace and Tiernan volumetric dry feed fluoridator, type NA, mounted on a scale. Our machine has a gear setting such that the maximum orifice opening will deliver a fluoride dose of only 2.5 ppm. Another precautionary measure has been taken by wiring the motor of the fluoridator in series with the lights in the treatment plant office and pump house. When the plant is shut down, main switches on the panel board are pulled; thus, the possibility is reduced to a minimum that the fluoridator would operate when the treatment plant is shut down. An attendant is constantly present while the plant is in operation.

We use sodium fluoride, 95 to 97 per cent purity, having 45 per cent available fluoride ion. The type colored Nile Blue is specified as an additional safety measure.

Following filtration, the sodium fluoride solution is fed into the plant clear well at the point where the filtered water is discharged from a header to which the three filters are connected. Our raw water has a fluoride ion content of approximately 0.1 ppm. We maintain a fluoride ion concentration of 1.1 to 1.2 ppm in the distribution system, and find no loss of residual occurs. (We find it of interest that several former natural gas wells located on our watershed have developed into artesian water wells, and that the water from these wells contains 2.7 ppm. fluoride ion.)

Fluoridation Costs and Control

The total cost of our installation, including one-half ton of sodium fluoride, was $914.75. This cost covered the dry feed fluoridator, solution hose (1½-inch size), colorimetric fluoride testing equipment, sample bottles, mailing cartons, and the required laboratory supplies. The cost per capita for fluoridation, including operation and depreciation during the first eleven months, was 19 cents.

No full time chemist is employed at our small plant. Four samples (two raw water and two treated water) are submitted monthly to a consulting chemist for analysis. One copy of his analysis is submitted monthly to the Pennsylvania Department of Health along with our daily report sheet on

BOROUGH OF BROOKVILLE, PA. — FILTER DEPARTMENT
FLUORIDE APPLICATION

_____ 19____

DATE	OPR.	GALLONS TREATED PER M	SCALE READINGS START LBS.	SCALE READINGS END LBS.	TOTAL Na F FED	Na F DOSAGE PPM	RESIDUAL PPM: FILTER PLANT RAW WATER	FILTER PLANT LABORATORY	FILTER PLANT WATER PLANT RESIDENCE	DISTRIBUTION SYSTEM LOCATION	DISTRIBUTION SYSTEM PPM	DISTRIBUTION SYSTEM LOCATION	DISTRIBUTION SYSTEM PPM
1													
2													
3													
4													
5													
28													
29													
30													
31													
TOTAL													
AVERAGE													
MAX.													
MIN.													

SIGNED _____

DAILY RECORD of fluoridation—Three plant samples and two distribution system samples are tested for fluoride content

fluoridation which shows the results of the five samples run daily in the plant laboratory.

Fluoride residual tests made by non-technical personnel in our plant have never differed by more than 0.1 ppm from the results of analyses made by our consulting chemist. Our consultant follows the procedure given in *Standard Methods for the Examination of Water and Sewage*, and makes a charge of $3.75 for his analysis of each sample. The operation of our own testing equipment (involving only the cost of preparing the fluoride reagent each week) is such that 422 samples can be tested for $4.90.

Plant Testing Equipment

For our plant testing equipment we use the Hellige Aqua Tester No. 611. This can be used for a variety of colorimetric tests in addition to that for fluoride ion. Permanent color discs are available to measure the concentration of fluoride, chlorine, iron, manganese, and other ions. This Tester is the equipment recommended by the Pennsylvania Department of Health for plant control of fluoridation. The advantages of this equipment include the use of long Nessler tubes (viewing depth 200 mm.), the provision of a constant light source (a fluorescent bulb located below the tubes), and the permanent glass color standards.

READING COLORS made easy and accurate by black cloth hood

The proper procedure in making the fluoride test is easy to follow: To a 50 ml sample in a glass stoppered volumetric flask, add exactly 2.5 ml of fluoride reagent and mix well by inversion. Note the time and let sample stand for color development exactly one hour. The sample should then be poured into the Nessler tube to the graduated mark, insert glass plunger in top of tube so its end will be immersed in the liquid, and place this tube in the right hand opening of the stage. Another Nessler tube is filled with untreated water and place on the left hand stage to take care of color or optical compensation. By revolving the disc, a color comparison is quickly obtained. The disc is calibrated from 0 to 1.6 ppm F, and higher concentrations can be read by diluting the sample with distilled water prior to adding the reagent. Readings are in 0.2 ppm subdivisions and the color match is made or the unknown value may be estimated by interpolation.

Color intereference may be found to result from high chlorine residuals in the water; it can be compensated for by adding a sodium arsenite solution or a solution of sodium thiosulfate, prior to adding the fluoride reagent. We always use one drop of a 0.1 per cent solution of sodium thiosulfate, mixed by inversion, and then add the fluoride reagent. When water temperatures are low, as we find them to be during greater part of the year, the samples are first heated to the recommended temperature of between 23° and 27° C.

Clean glassware is important and the Nessler tubes when not in use are kept partially full of clean water to prevent deposition of dried residue. Bottoms of tubes are kept dry and the filter plate over the light source is kept clean.

The fluoride reagent used with the Aqua Tester employs the same components as those used in the *Standard Methods* determination. This reagent is stable for 4 or 5 weeks only if refrigerated. Our experience indicates no refrigeration to be required when the reagent is made fresh each week and stored away from direct sunlight. We have found storage of the 100 ml. bottle of reagent in a sample mailing carton to be most convenient. All necessary directions for reagent preparation are provided with the Aqua Tester equipment.

An Original Improvement

We have developed a simple but important improvement in the technique of making our plant control tests. Its use has greatly increased the ease and accuracy of determining residual fluoride concentration. As we believe this improvement is not generally used, a description of it may prove helpful to other plant and laboratory workers.

The color fields seen in the prism on top of the Aqua Tester should not receive direct light from behind the person making the observation. If all sunlight and artificial light can be eliminated, comparison is quite simple and quick. The darker the interior, the easier and quicker the comparison. The color fields seen in the prism on top of the instrument are viewed so that there is no shadow effect in either half of the field.

It was found that a yard of black cloth thrown over the instrument and the head of the observer would eliminate all light interferences and simplify the procedure. This is especially true on bright days. The operator sets the color standard disc at zero, clasps the black cloth under his chin. Thus,

the observer has no opportunity of seeing the disc reading until after the comparison is made and the black cloth has been removed. This discourages any observer who may have a tendency to "peek" at the disc reading to see if it is where he "thinks" it should be.

A Brief Background

The original Brookville water system—dam, filtration plant and storage tank—was privately constructed in 1911. In 1912, the Brookville Borough purchased the system and established its Water Department.

Subsequently, the pumping equipment, chemical feeders, and chlorinators have been modernized; flocculation units and filters have been added. The storage capacity of 320,000 gal. has been increased by construction of a 2.0 million gal. concrete reservoir.

The distribution system, originally including 9.6 miles of mains, has grown to 20.4 miles (of 4-in. to 12-in. diameter C.I. pipe). New mains laid are not less than 6-in. diameter. Free water service is provided to 108 fire hydrants and to 12 sprinkler systems, as well as for all street and sewer flushing services.

The population served by the Brookville Borough Water Department is 4,800, and water consumption averages 25 million gal. per month. Of the 1,600 services in the system, 800 are metered. A metering program is expected to be 100 per cent complete by the end of 1953.

Water rates today are the same as those originally set in 1912. There is no bonded indebtedness on the system. As of January 1, 1951, the depreciated value was $303,601; the net income was $16,000 to $18,000—or slightly greater than six per cent.

Large Issue of Revenue Bonds for L.A. Water System

A $5,000,000 revenue bond issue for expansion of the Los Angeles water system was authorized by the Water and Power Commission in December.

This issue was followed by another $5,000,000 in bonds to be sold in January.

Samuel B. Morris, general manager of the Water and Power Department, said the bonds will be paid for out of department earnings.

"Continued expansion of water facilities is necessary to keep ahead of increasing demands resulting from growth of population and industry," he said.

N. P. A. Approves 703 Additional Water & Sewage Projects Costing Almost $350,000,000

Total for First 9 Months of 1952 Over $1,000,000,000

The latest release from The Water Resources Division of the National Production Authority shows that 703 communities will benefit from new or additional water and sewage facilities. The detailed list shows projects which were approved and received allocation of all necessary materials under the Controlled Materials Plan for the Third Quarter, 1952. Water Projects total $215,570,241.00. Sewage Projects $127,455,400.00, making a total of $343,025,641.

When this is added to the value of projects approved for the First Quarter*, and Second Quarter**, the total of approved projects for the first nine months of 1952 is $1,471,121,385.53.

SUMMARY BY STATES AND TERRITORIES

ALLOTMENTS GRANTED BY WATER RESOURCES DIVISION OF THE NATIONAL PRODUCTION AUTHORITY

Third Quarter from July 1st, 1952, through September 30, 1952

States	Number of Projects	Value of Projects	
		Water	Sewage
Alabama	6	$ 362,713	$ 215,000
Arizona	7	38,000	—
Arkansas	4	503,541	398,875
California	116	24,286,872	17,159,733
Colorado	8	527,000	242,299
Connecticut	7	5,000	1,134,901
Delaware	3	11,400	2,161,500
District of Columbia	1	2,550,000	—
Florida	9	874,892	631,081
Georgia	14	6,775,622	2,251,143
Idaho	4	160,300	115,540
Illinois	35	4,183,583	5,512,298
Indiana	16	2,191,800	5,841,190
Iowa	18	264,156	835,124
Kansas	11	75,900	453,495
Kentucky	9	192,559	473,100
Louisiana	18	7,194,224	—
Maine	—	—	—
Maryland	16	9,962,000	3,440,625
Massachusetts	12	60,000	852,940
Michigan	37	46,582,851	8,783,955
Minnesota	11	1,020,556	2,259,924
Mississippi	11	1,361,826	955,893
Missouri	16	1,048,599	2,751,900
Montana	4	1,083,700	—
Nebraska	2	340,000	150,000
Nevada	1	—	255,000
New Hampshire	—	—	—
New Jersey	7	3,362,000	384,504
New Mexico	—	—	—
New York	35	58,101,471	27,759,523
North Carolina	8	884,047	294,947
North Dakota	—	—	—
Ohio	29	8,671,122	8,787,399
Oklahoma	11	1,886,529	1,899,641
Oregon	18	506,116	771,910
Pennsylvania	27	6,823,140	14,077,028
Rhode Island	2	—	654,273
South Carolina	12	2,222,088	1,366,141
South Dakota	2	1,239,516	—
Tennessee	11	1,990,285	642,817
Texas	80	8,286,751	5,648,864
Utah	1	—	1,476,421
Vermont	—	—	—
Virginia	23	496,649	3,103,461
Washington	15	2,920,815	571,843
West Virginia	3	1,062,800	—
Wisconsin	14	1,969,672	2,816,282
Wyoming	—	—	—
Alaska	—	—	—
Guam	—	—	—
Hawaii	5	2,169,140	253,430
Puerto Rico	4	1,320,000	71,400
TOTALS	703	$215,507,241	127,455,400

* Published in W&SW for August 1952—page 334.

** Published in W&SW for November 1952—page 454.

RESERVOIR cut out of solid rock, provides 1 mg. storage

Water Supply for Oakdale Colliery

An Australian Project, Involving a 1600 ft. Lift to Reservoir Cut in Solid Rock.

by H. BOWDEN FLETCHER, *New South Wales, Australia.*

WHEN it was decided to open and develop a coal seam at Oakdale, in the vicinity of Brimstone Gully, N.S.W., a problem of some magnitude was faced by the Metropolitan Water, Sewerage & Drainage Board of New South Wales to provide the essential and permanent water supply for the mine itself and the domestic use of the residents of the township, established to house the employees and their families.

The position of the mine, high up on the side of a hill, with no suitable stream in the vicinity which could be dammed, meant that there were only two alternatives available, viz:

1. The Extension of the existing mains from the nearest settlement.

2. A completely independent supply from the Wollondilly River 1,600 feet below.

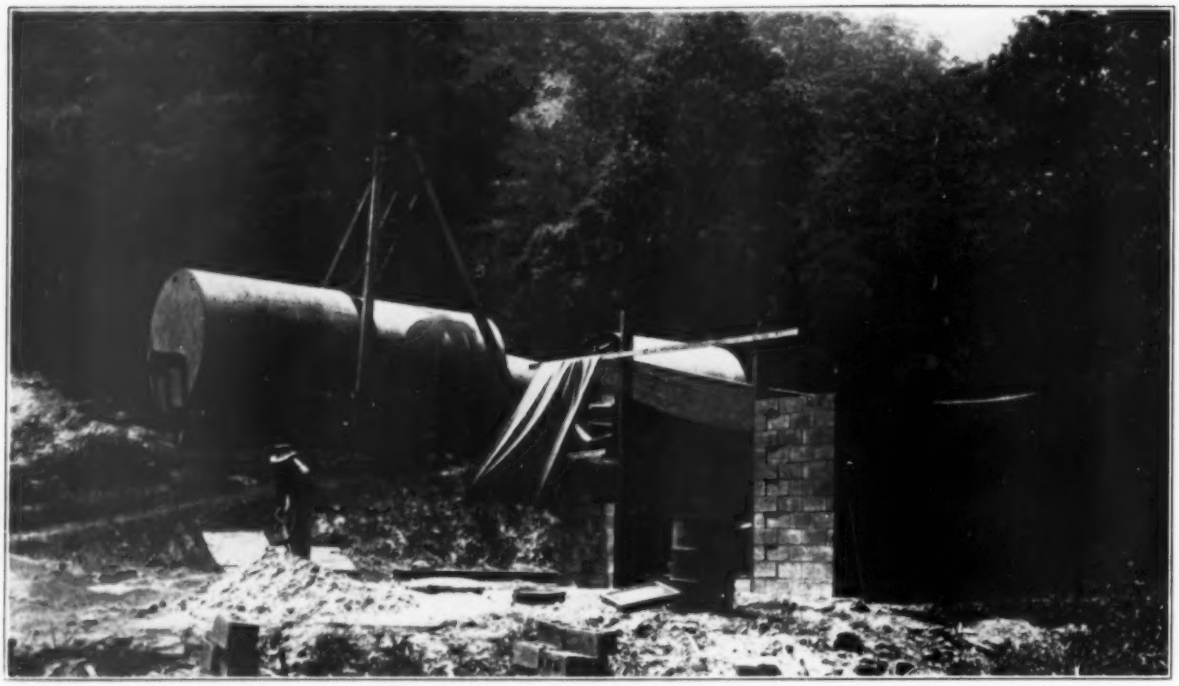
After a very thorough investigation and survey it was found that the second of the two schemes was by far the most satisfactory and economical. In addition, it could be completed in far less time than the first. It was therefore decided to go ahead with the Wollondilly scheme in spite of the fact that it involved pumping the water 1,600 feet up, in a distance of approximately one mile.

The Wollondilly river will be seriously affected by the construction of the Warragamba Dam (the largest in the Southern Hemisphere) as this major job will cause the water level in the Wollondilly to rise very considerably. Thus the river level pumping station to be erected at the commencement of the scheme, under review, will be one of a temporary nature and the permanent station will be constructed some 300 feet higher.

It is interesting to recall that when the Warragamba Dam is complete it will impound nearly four times as much water as Sydney Harbour.

The Oakdale Scheme

The Oakdale Scheme, which is now well under construction, provides for pumping the water from the Wollondilly, just downstream from its junction with the Nattai River, through a rising main, ascending a steep hill, bordering the Burrogorang Valley, to a million gallon reservoir. From the reservoir



SUCTION TANKS of Pump Sta. No. 2 being placed

the water will be gravitated to the mine and the township to be supplied through an 8 inch cast iron cement lined pipe line.

Pumping Stations

Naturally the greatest problem, associated with the scheme, was the difference between the river or pumping level, and the storage reservoir. This difference is 1,600 feet in a horizontal distance of 6,000 lineal feet for the level at the river off-take is R.L. 250 and that of the reservoir R.L. 1868. To handle the pumping efficiently it has been necessary to construct two intermediate pumping stations, complete with suction tanks, one at R.L. 815 and the other at R.L. 1,380. The lift in the first place will be approximately 565 ft. with a friction head of 4 ft. and the second stage will have a lift of 540 feet. The location of these pumping stations was only decided after a very exhaustive investigation and survey.

The intake pumping station and No. 2 are each designed to give a delivery of 215 Imperial gallons per minute at a head of 369 feet and No. 3 the same delivery at a head of 510 feet. At No. 3 Station, the highest one up the scarp, there will be two pumping outfits, each with the same capacity, one being in reserve for an emergency.

For satisfactory operation with the three stations in series, the units in the temporary and No. 2 Stations will be balanced with the units in No. 3 Station. To operate with maximum efficiency all units must meet the capacity required within a range, plus or minus, 5 g.p.m., and in the permanent stations arrangements are provided for three units and the parallel working of any two. Operation must be stable up to maximum heads. The stations will be automatically and remotely controlled, the temporary station, at river level, from the service reservoir, beginning operation when the water level falls 5 ft. below T.W.L. and cutting out when the water rises to T.W.L.

Pumping from Nos. 2 and 3 Stations will cut in when the water level in the respective suction tanks is at T.W.L. and cut out when the water level falls 2 ft. below T.W.L.

The buildings, to house the pumping plant, will be large enough to accommodate three units, with the essential electrical equipment, should this become necessary at a later date. All pumps will be electrically operated.

The pump at the temporary station will be connected to the suction main, which will be provided with a foot and trash screen while the pumps at 2 and 3 stations, as previously mentioned, will be connected to suction tanks each of 5,000-gallon capacity. These suction tanks located as close as possible to the pumping station, will be constructed from reinforced concrete cylinders laid on their sides, on saddles, with the ends blocked with concrete. These circular tanks are built up from 6 ft. diameter reinforced concrete pipes, the ends of which are left ragged with the reinforcement protruding in order that the concrete ends can be incorporated with the minimum trouble and maximum efficiency.

Storage Reservoir in Solid Rock

The rising main, from the temporary pumping station to the storage reservoir, consists of 7,670 feet of 8 in. cast iron cement lined pipe. From the reservoir to the mine the outlet main will be 19,061 feet of the same type and size of pipe.

The site of the service reservoir was selected to give the necessary heads for the pumping stations and is located half a mile along the old access road from its junction with the existing road.

To economize in the use of steel, a very scarce commodity, it was decided to excavate this reservoir in the side of an almost solid rock hill through an opening 20 feet wide and enlarge the excavation to provide a space 150 ft. x 60 ft. x 20 ft. in the sandstone. At the commencement the surface material was dozed out by a Caterpillar D 7 tractor fitted with dozer blades of varying sizes, to suit the job of the moment. Once the solid sandstone was reached the method of attack was as follows:

Using four-wheeled portable type compressors (Armstrong-Holland), of 160 and 230 c.f.m. capacity, the sandstone was drilled to the depth of 20 feet, charged with 50 per cent

gelignite and fired. The spoil was then dozed out through the 20 ft. opening by the Caterpillar D7 and pushed over the side of the scarp. Precussion type drills using ⅞ in. hexagonal steel with detachable tungsten carbide bits were used.

The complete excavation is being lined with concrete unreinforced, and the opening blocked with a reinforced concrete wall. The walls themselves will be 18 in. thick on the side nearest the road, to act as a precaution against leakage through rock seams. On the other three sides the walls will be 9 in. thick.

The concrete mix used is 5 bags of cement to the cubic yard, 28 day compressive strength required being 3,200 p.s.i. and the cement-water ratio 1.8 by weight. To make sure of obtaining the best possible mix ¾ and 3/16th inch river gravel is used with a combination of river and Botany sand. The gravel is secured from local river sources but the sand is transported from its sources many miles away.

The roof covering of the reservoir will be of light malthoid supported on timber frames and timber uprights.

The Water Treatment Plant will be located on top of a nearby hill, slightly to the north, to provide the necessary levels and gradients. There are to be three chemical dry feeders installed, each with a capacity of up to 100 lbs. of sulphate of alumina per hour.

Laying the Rising Main

Due to the extreme steepness of the route the laying of the rising main has been almost entirely a job of man-handling, assisted by improvised rope lines and hand billies. On the steeper section the pipes have had to be strapped down to the rock and where filling has been necessary concrete blocks have been placed to provide the essential support. Hand packed rubble has largely been used and, in the worst places, this has been grouted as a means of extra safety. The possibility of scouring, in heavy rain, has been attended to by the construction of cross drains on the upper side of the foundation blocks.

Providing the concrete for these foundation blocks has been no sinecure and the only way has been the employment of small portable mixers which have been lowered to a position as close as possible to the job. This has all been done by means of temporary rope lines secured to suitable trees and the application of considerable man power. From the mixer the concrete has been chuted to the actual job, distances ranging from 50 to 80 feet. The aggregate for the mix has also invariably had to be man-handled down from the top of the scarp as it would have been too expensive to have rigged modern techniques for the small quantities to be handled. The same method of handling the concrete has been used for the foundations of the three pumping stations and has been one of the real problems associated with the job. However, to save the men, full use of ropes, pulleys and trees has been made where it was possible.

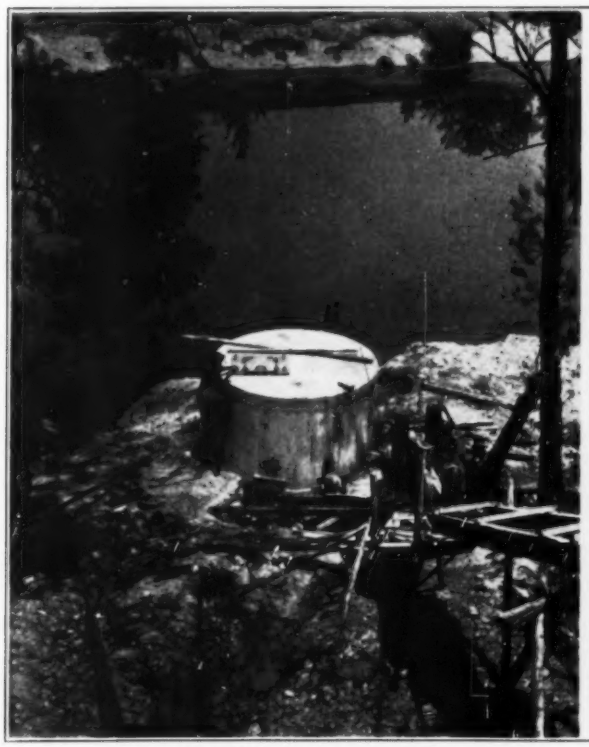
For the reservoir itself it was possible to install a Britstand 15 cu. ft. drum type batching and mixing plant with a 415-volt 3-phase electric drive alongside. The concrete itself was moved to the job in barrows.

As local supplies have been extremely short, the pipes have been imported and the cement lining handled by Rocla Limited, a local organization.

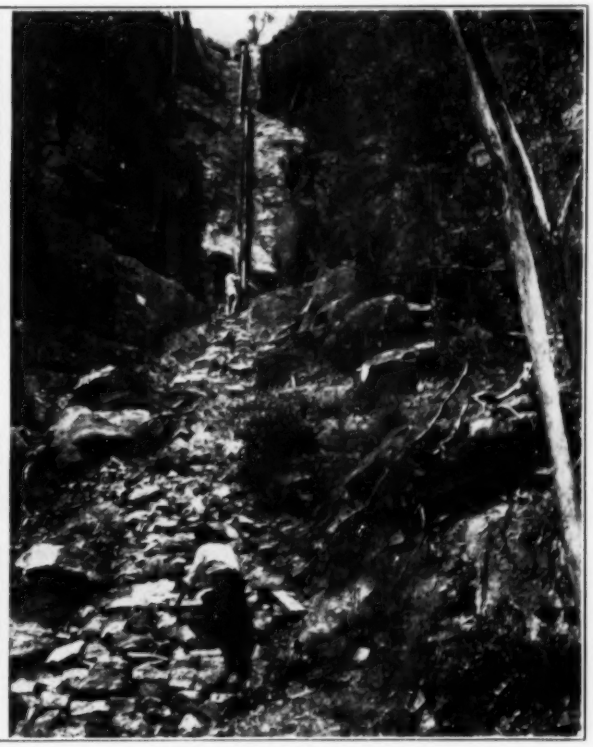
Although weather and shortages of materials have delayed the completion of the work, the distribution of the water should be possible before the end of the current year.

Acknowledgement

This article was prepared from information supplied by the officials of the Water Board and the photos are also supplied by the Metropolitan Water & Sewerage Board whose co-operation is gratefully acknowledged.



FOUNDATIONS, River Pumping Station



RISING MAIN under construction.

Senior Author

Chlorine and Chlorine Dioxide for Control of Algae Odors

Properly Applied, These Oxidizing Agents Solve Problems in Plant Operation

by C. R. HARLOCK, *Superintendent, and* M. R. DOWLIN, *Operator*
Eden Creek Filtration Plant, McNeil Island, Wash.

THE raw water supply of the Eden Creek Filtration Plant is surface runoff which is impounded during winter months. It is a highly colored water, the color being derived from organic materials.

From the middle of September to the middle of June, the problem is simply color removal. During this period, odors are at a minimum. It is our experience that the color must be completely removed if odors are to be kept out of the distribution system. It is our practice to carry a chlorine residual of at least 0.2 ppm in dead ends. If there is any organic matter in the water leaving the plant, it will first react with chlorine present and there will then be a medicinal chlorine smell at the cold water tap. If there is not enough chlorine to react with all the organic matter present, then bacteria counts will increase enormously; anaerobic conditions will develop, and the water will have a vile swamp taste.

From the middle of June to the middle of September the problem is the removal of color, iron, manganese, and odors caused by algae. Anabaena is the predominating organism. Our impounding reservoir has swampy areas that would be unprofitable to drain. We treat regularly with copper sulfate and are able to keep the algae under control, but we are not able to eradicate it. Due to the high organic content of the water, septic conditions develop in the bottom of the reservoir about the first of July. This area has the greatest concentration of iron, manganese and odors, and it is devoid of oxygen. Water in the top three feet of the reservoir has the greatest concentration of algae. It is supersaturated with oxygen. The odors are almost as bad as those from the bottom zone. Water in the top three feet also has the greatest chlorine demand. Eight feet below the surface seems to be the area having the least odor. Anabaena appears regularly each year when the water reaches 14°C and disappears when the water reaches 13°C.

Chlorine for Odor Control

Chlorine demand tests are run regularly so we will have a continuous picture of the demand curve. This water does not have a break-point. Instead, it exhibits a series of plateaus.

These plateaus are in the form of an arithmetical progression of approximately 6 ppm frequency. The length of the plateaus is approximately 2 ppm. The residual is a function of time. See Fig. 1.

In the winter months, we chlorinate to the end of the first plateau. We determine what chlorine dosage shall be applied by odors at the hot water tap. Whenever an odor develops at the hot water tap, we immediately increase the chlorine dosage to the end of the next plateau. The retention through the plant is approximately six hours. If the odor still persists after six hours, we increase the chlorine dosage to the end of the next plateau, etc., until there is no odor at the hot water tap (80°C).

With this method, all swamp or algae odors can be destroyed. However, there is a decided chlorine odor at the cold water tap. It was noticed that this odor rapidly disappears when the water is left standing in an open vessel. We tried aerating the finished water and found that there was a definite loss of residual chlorine until a constant pH was reached. Beyond this point, the residual was stable. Also, there was no odor of any kind in the water.

We then dosed chlorine-demand-free distilled water with 10 ppm of chlorine. Aeration gave no reduction in the residual. Neither could we detect any odor of chlorine.

Aeration Proves Beneficial

With this information, we installed an aerator where the water enters the clear well. For effective color removal, we have to filter at pH 5.8 to 6.4. Aeration raises the pH to 7.4. By aeration, we remove both the carbon dioxide (dissolved in the water from the alum reaction) and the dissolved gases having the medicinal chlorine odor. We find that it takes between a third and a half of a cubic foot of air per gallon of water to reach a constant pH. Also, we find that it is much cheaper to aerate the carbon dioxide from the water than it is to neutralize it with lime or soda ash.

Sulfur Dioxide Investigated

Tests were also run with sulphur dioxide as a dechlorinating agent. We found it successful. It is very selective. It first destroys those com-

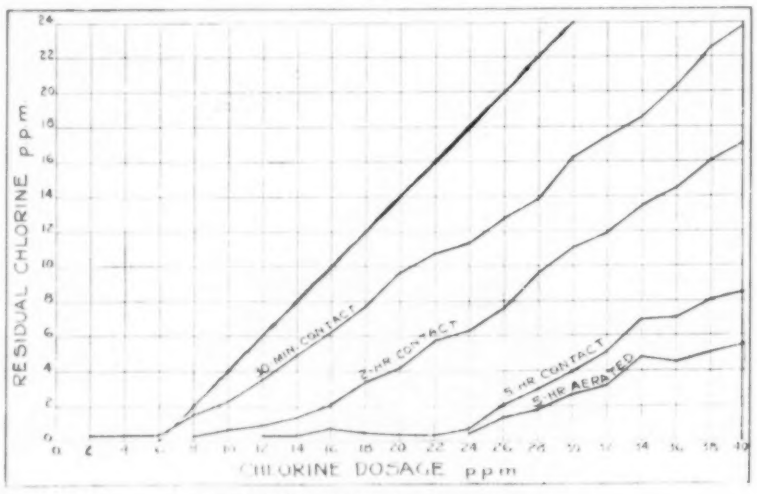


Fig. 1—TYPICAL Chlorine Demand Curves Showing the Demand as a Function of Time
(Residuals were determined by titration, using acetic acid—starch iodide)

pounds which cause the chlorinous odor, leaving an odor free water. Again, with this method, we must go high enough with the chlorine dosage to destroy all odors at the hot water tap. The contact time with our water must be at least six hours. Aeration tests were run to see how much chlorine could be aerated from the water. Dechlorination was carried slightly beyond this point. The sulphur dioxide was metered through a Wallace & Tiernan chlorinator during these tests.

This method was decided against because:

Its reaction produces two more acids in the water that have to be neutralized.

It requires close control.

It is higher in cost.

Manganese Removal

Manganese has been very troublesome in our supply during the summer months. From all the literature we have read, it appears that the pH value must be raised to 9.2 or above in order to flocculate manganese. This would be impossible at our plant as we must filter at pH 5.8 to 6.4 in order to remove the color.

The water leaving our mixing chamber has no color. In past years, we noticed that color returning in the settling basin was directly proportional to the amount of manganese present in the raw water. Also, that our filter runs were inversely proportional to the amount of manganese present in the raw water. The filter effluent had no color. It was apparent that the chlorine was oxidizing the manganese to the colloidal state where the filters could remove it. On a hot day in summer when the demand for water is greatest and filter runs drop to six hours, the operation of a water treatment plant can be very disheartening. That is a good time to sit down and think.

If the chlorine is oxidizing the manganese, but it requires time lasting until after the floc has settled to do so; why not use a stronger oxidizing agent and oxidize the manganese ahead of the mixing chamber? We then ran a chlorine dioxide demand test on the water which is here illustrated. It was at once apparent that chlorine dioxide alone would be prohibitive in cost. See Fig. 2.

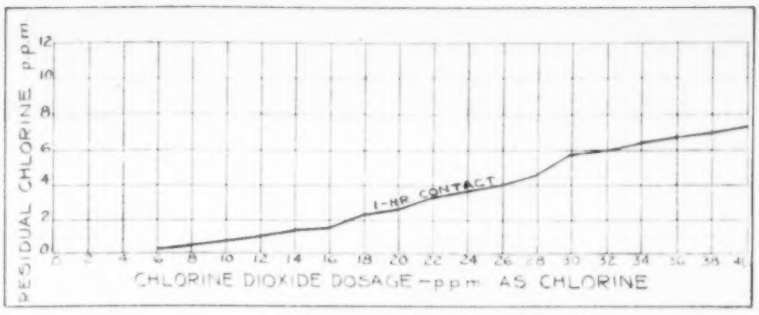


Fig. 2—CHLORINE Dioxide Demand Curve

(Residuals were determined by titration, using acetic acid—starch iodide)

Then we ran a demand test by adding chlorine dioxide to water which had already received the regular chlorine dosage that we were then using. It is illustrated in Fig. 3. The color of the water in the beakers immediately darkened. When the regular dose of alum was added, the floc formed was burned chocolate in color instead of the usual cream color. After settling, the color did not reoccur. Analysis showed that all manganese had coagulated and settled.

We then ran a plant test. Sodium chlorite solution was fed to the solution chamber of the chlorinator in increments of 5 lb. per mg. until the water in the settling basin had a color of zero. Filter runs immediately increased from six to sixty hours. We were chlorinating at the end of the second plateau (100 lb. per mg.) when we started to use the sodium chlorite. Ordinarily, at that time of the year, we have to go to the end of the seventh plateau to get complete odor removal (360 lb. per mg. of chlorine).

We continued the rest of the summer without having to raise the chlorine dosage above the second plateau. The sodium chlorite dosage varied from 10 lb. per mg. to 20 lb. per mg., depending on the amount of manganese present. The average was about 15 lb. per mg. The cost of water treatment chemicals the same, but it was much easier to control odors with the use of chlorine dioxide. We had the added advantage of clean filters, long filter runs, and the removal of the manganese in the settling basins.

Towards the end of the season we became curious as to just how much we could do with this system in the line of odor removal. We deliberately let the impounding basin bloom with Anabaena. We were able to turn out an odor free water with this method.

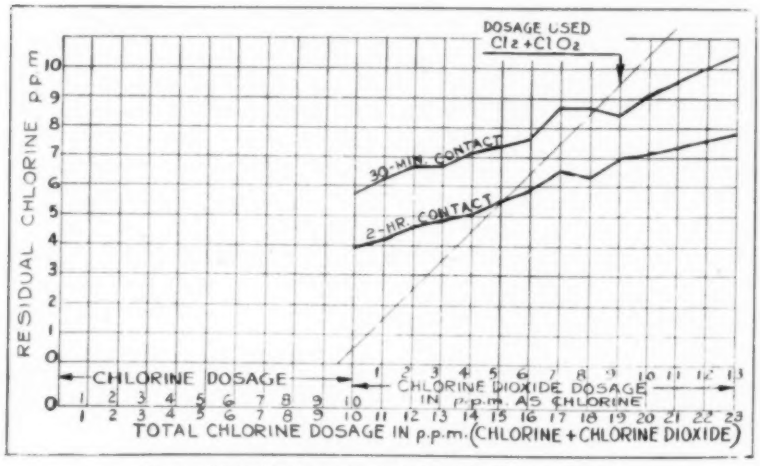

DOSAGE USED Cl2+ClO2
RESIDUAL CHLORINE p.p.m
30-MIN. CONTACT
2-HR. CONTACT
CHLORINE DOSAGE
CHLORINE DIOXIDE DOSAGE IN p.p.m. AS CHLORINE
TOTAL CHLORINE DOSAGE IN p.p.m. (CHLORINE + CHLORINE DIOXIDE)

Fig. 3—DEMAND Curve for Chlorine and Chlorine Dioxide

(Note that chlorine dosage was 10 ppm before the addition of chlorine dioxide)

Conclusions

We find that we can eliminate any odor caused by algae with the use of chlorine.

The chlorine dosage must be maintained high enough to destroy all odors at the hot water tap (80°C).

The chlorine reaction time must be at least six hours for our water. This reaction time can be reduced by the addition of chlorine dioxide.

The finished water must be aerated to a constant pH. For our water, between a third and a half of a cubic foot of air is required per gallon of water.

Manganese can be removed by coagulation with an alum floc at a low pH value if it is previously oxidized by the application of chlorine dioxide.

Canadian Sewage Institute Meets at Seigniory Club in Quebec

Registration is 273 at Nineteenth Annual Convention

Presidents

Outgoing	Incoming
C. S. Anderson	*G. H. Baker*
Works Commr.	*Engineer*
Tisdale Twp., Ont.	*N. York Twp., Ont.*

THE nineteenth annual convention of the Canadian Institute on Sewage and Sanitation met Nov. 3-5, 1952, at the Seigniory Club, Montebello, Quebec. All sessions and social events were held in the Log Chateau of this sport and country club on the north shore of the Ottawa River, some forty miles east of the city of Ottawa. This highly successful meeting of the Institute was the first to be held within the Province of Quebec, and its second at a resort area.

The program included scheduled luncheons, dinners, and entertainment for members and guests. Registration at the convention was 273, of which number 74 were ladies. The present membership of the Institute is 410.

Once again the convention entertainment was provided by the Sanitation Equipment Association: the "Club Room" was a regular and enjoyable before - and - after dinner feature, while the floor show and dance following the annual banquet contributed materially to the success of the meeting. A part of one afternoon was devoted to a tour of the attractive and extensive grounds (85,000 acres) of the club. For the ladies, an afternoon tea and other special events were provided.

The Past-Presidents' luncheon, a feature of recent conventions, provides an opportunity for executive members to consider ideas for improving meetings. Location of the 1953 convention has not been determined, but will probably be at Hamilton, Ont.

New Officers

The following officers were elected to serve the Institute for the coming year:

President

Gordon H. Baker, Engr.
North York Township, Ont.

Vice-President

A. E. Chalmers, City Engr.
Peterborough, Ont.

Secretary-Treasurer

A. E. Berry, Dir., San. Engr. Div.
Ontario Dept. of Health
Toronto, Ont.

Trustees

N. S. Bubbis, Genl. Mgr.
Water and Sanitary Districts
Winnipeg, Man.

E. E. W. Oke, City Engr.
Waterloo, Ont.

W. H. Collins, Deputy City Engr.
Hamilton, Ont.

W. K. Sharpe, Dir., Div. of Eng.
Dept. of Health
Charlottetown, Truro, N.S.

Director, FSIWA

N. MacNicol, Commr. of Works
Forest Hill, Ont.

Representative, Equip. Assn.

Bertrand Robinson, Hardinge Co.
Toronto, Ont.

Guest Speakers

Professor Earnest Boyce, Past President of the Federation of Sewage and Industrial Wastes Assns., (Chairman, Civil Engineering Dept., Univ. of Michigan), was guest speaker at the business meeting and at one of the luncheons. He described the progress made by the Federation in its 25 year history and brought the Association's greetings to the Institute.

Leslie H. Saunders, vice-chairman of the Toronto Board of Control, also guest speaker at a luncheon, discussed "Public Relations in Public Service."

Presentations

Presentations were made to D. A. Roy McCannel, City Engr., Regina, Sask., (Past President's Certificate), to Retiring President C. S. Anderson,

Officers

Vice-Pres.	Secy.-Treas.
A. E. Chalmers	*A. E. Berry*
City Engr.	*Health Dept.*
Peterborough, Ont.	*Toronto, Ont.*

Commr. of Works, South Porcupine, Ont., to Prof. Boyce, and to Mrs. Boyce. At the banquet, gifts were presented by the Equipment Association to ladies at the head table and to many guests holding winning door prize numbers.

Equipment Associations

The Canadian Sanitation Equipment Association works closely with the Institute in promoting the interests of municipal sanitation, in addition to assisting in convention arrangements and sponsoring entertainment.

This Association elected new officers to serve for the following year:

Chairman—Vert Rayner, Concrete Pipe, Ltd., Toronto.

Secretary-Treasurer—George Morgan, Victaulic Co. of Canada, Ltd., Toronto.

Trustees—Harold Woolidge, W & T, Ltd., Toronto; G. G. Vincent, Chem. Div., CIL, Ltd., Montreal; C. E. Napier, Chas. E. Napier Co. Ltd., Toronto; J. B. Kinney, W & T Ltd., Toronto; and Howard Price, United Steel Corp. Ltd., Toronto.

Pollution Symposium

The technical program included several papers on various phases of industrial and municipal waste disposal problems, and four guided discussions.

"Investigation of Pollution in the Spanish River" is the title of a symposium comprising four related technical papers. The investigation described was directed by a board of technical advisors set up by the Ontario Research Council. An introduc-

tion to the problem involved was given by the first paper, and the three succeeding papers discussed detailed studies.

The Problem

A. V. DeLaporte, Chemical Engineer, Ontario Dept. of Health, Toronto, Ont., briefly outlined the problem and described the characteristics of the stream.

The Spanish River is the largest stream west of the French River flowing into Lake Huron; its watershed is nearly 100 miles long and is 30 to 40 miles wide. The spring flows generally give a scouring velocity which clears the rive bottom of bark, fibre, and other deposits.

The river is used as a source of power by the International Nickel Co. at High Falls and by an electric generating station (20,000 HP) at Espanola, the later operated by the Kalamazoo Vegetable Parchment Co. Industrial wastes are discharged to the river by the KVP Co., as is the untreated sewage from the village of Espanola. The river transports wood pulp, serves the farmers for watering livestock, and is a summer resort area. The KVP plant is a modern bleached

FSIWA Directors

Outgoing	Incoming
Wm. Storrie	*Nicol MacNicol*
Cons. Engr.	*Works Commr.*
Toronto, Ont.	*Forest Hill, Ont.*

sulfate mill, originally designed for 200 tons per day capacity, but operating in excess of 275 tons per day during the period of the study.

The KVP mill discharges 30 cfs daily to the river. Since average stream flow for most of the year is about 3,000 cfs, this involves a ratio of 1 to 100. During normal plant operation, the mill wastes require a flow of 2.25 miles to become thoroughly mixed with the stream flow.

As the kraft process came into production gradually, during 1946 and 1947, chemical wastes were discharged which would have been recovered had the mill been in full operation. Court action over these discharges was brought by riparian land owners downstream from Espanola, and judgment favoring the plaintiffs was sustained by every court through to the Privy Council. One provision of the injunction would have closed the KVP mill in April 1950, and Espanola would have become a ghost town.

Legal history was made when the Ontario Legislature passed an Act which dissolved the injunction and made provision for the Research Council of Ontario to investigate the condition of the river. The investigation was designed as a basis for developing methods to remedy any causes of contamination. Chemical and biological field studies were made by Mr. DeLaporte and by Prof. J. R. Dymond, Head, Dept. of Zoology, University of Toronto, jointly heading a Board of Technical Advisors.

Findings revealed that chemical wastes, during average operation, do not upset normal stream quality; "slugs" of toxic wastes have killed large numbers of fish. Loss of fiber has been reduced (from 6.7 down to 3.5 tons per day) by tightening operations. Old fibre deposits in the river have been scoured out and deposited in the lower river and lake, changing the character of the bottom as a spawning and feeding ground for fish.

It was recommended that no "black liquor" should be discharged from storage tanks to the river. The lagoon should be modified to improve settling, retain spills, prevent foam from reaching the river. Additional fibre should be reclaimed. Separate treatment should be provided for treating the sanitary sewage from the KVP Co. and from the settlement of Espanola (primary settling, sludge disposal, and seasonal chlorination).

Biological Studies

R. Ferguson, University of Toronto, Toronto, Ont., described in detail the biological studies made by field personnel. He reported these as showing conditions in the 20 miles of the stream immediately below the KVP mill to be markedly different from those above the mill or in that part of the river farther below.

Chemical Studies

J. Wilkinson, City Dept. of Health, Toronto, Ont., reviewed the chemical studies made. He outlined the operation of the sulfate process, including the operation of multiple effect evaporation for chemical recovery; the effect of the chemical wastes on the stream; and treatment of wastes required to protect the stream quality.

Fibre in Stream Water

Ian G. Simmonds, Chemical Engr., Ontario Dept. of Health, presented a discussion of fibre in river water, and described in detail the development of micro-technique to differentiate species of pulp and the process of preparation used. Qualitative and quantitative methods of analyses were employed. It was possible to calculate the composition of fibre by relative number, relative weight, and concentration in parts per million. Most of the fibre originated from KVP mill operations.

Treatment of Milk Wastes

N. D. Woolings, Imperial Oil Ltd., Montreal, P. Q., presented a paper titled: "Research on Treatment of Milk Plant Wastes." Mr. Woolings was formerly chemical engineer, San. Eng. Div., Ontario Dept. of Health.

He pointed out that there is currently a general decrease in the total number of milk processing plants—as the result of a trend toward larger and more flexible plants which are served by wider milksheds. In the three year period, 1948 to 1951, milk processing plants in the Province of Ontario decreased 16 per cent in

San. Equip. Assn.

Secy.	New Trustee
George Morgan	*J. B. Kinney*
Victaulic Co.	*W & T Co.*
Toronto, Ont.	*Toronto, Ont.*

number and cheese processing plants decreased 26 per cent.

In large communities milk wastes are generally discharged to municipal sewers and, sufficiently diluted, can be handled in the routine treatment process. In small towns, separate treatment or pretreatment of milk wastes may be required because of the disproportionate load which the wastes impose. In Ontario, 64 per cent of the milk processing plants must handle their own wastes; i.e., 720 plants out of 1,132 plants are not connected to municipal sewers.

Mr. Woolings reviewed the sources and composition of milk processing wastes. Solving the milk waste problem should start with improved housekeeping within the plant itself. Then surveys should be made to evaluate

Programmers

A. V. DeLaporte
Chem. Engr.
Ont. Health Dept.
Toronto, Ont.

J. Wilkinson
Chief Chemist
Sewage Plant
Toronto, Ont.

volume and strength of wastes which must be treated. Dilution should be considered as the first potential method of waste treatment—even if pretreatment may be required (chlorination might be sufficient). Land disposal, by broad irrigation, may be a suitable treatment — especially for small plants. Anaerobic digestion was offered as the most applicable treatment for small milk plants in Ontario; the waste volume should be less than 4,000 gal. per day and soil conditions must be suitable for subsurface disposal of the treated effluent.

The trickling filter, generally considered most suitable for treatment of milk wastes at larger processing plants, is giving way to activated sludge treatment. The latter has the advantages of lower construction cost and lesser sludge disposal problems; it is a more flexible treatment process, and is more applicable during winter months. Pilot plant studies were made with both trickling filter and activated sludge units to determine applicable loadings and B.O.D. reductions accomplished.

Sludge Disposal Methods

N. S. Bubbis and D. L. McLean are authors of a paper: "Sludge Disposal Methods for Canadian Conditions." The authors are, respectively, General Manager and Superintendent, Greater Winnipeg Sanitary District, Winnipeg, Man. Mr. McLean presented the paper.

Experiments to determine the feasibility and practicality of lagooning its sludge have been undertaken by the District. These are not completed or conclusive, but some data and results can be reported.

Of the 200 Canadian sewage treatment plants, 77 use some method of dewatering the sludge prior to disposal, 11 plants haul liquid sludge to farms, and the remaining 112 plants dispose of their sludge by miscellaneous methods (lagooning, trenching, burying, etc.). The survey from which these data are cited indicates a significant trend: in the last ten years the disposal of liquid sludge by tank truck direct to farm land has superseded the use of drying beds, and is now used in 11 Canadian plants.

The Winnipeg treatment plant provides primary treatment, sludge digestion, elutriation, vacuum filtration, and outdoor storage of sludge. Ferric chloride has increased in cost from 4.3 cents per pound (1940) to 8.8 cents (1952). Put another way, the cost of ferric chloride per ton of filtered sludge (dry solids basis) increased from $2.65 in 1940 to $7.40 in 1952.

In analyzing factors applying to enlargement of the District's present facilities, the consulting engineers found one large clarifier and four new digestors will be required. If the same method of handling digested sludge is followed, two new elutriation tanks and enlargement of existing ones, two additional vacuum filter units, and extension of the filter room will be necessary. Estimated capital expenditure required for the vacuum filter extensions is $321,000 more than the cost of lagoons. Estimated operating cost for vacuum filters is $60,000 per year more than for operating lagoons. The economy of utilizing lagoons appeared worthy of study.

Presentation

Recipient

Prof. Earnest Boyce
Past Pres. FSIWA
Univ. of Mich.
Ann Arbor, Mich.

Presenter

Dr. T. J. Lafreniere
Chief San. Engr.
Ministry of Health
Montreal, Que.

Six test lagoons and two sludge drying beds were constructed. The lagoons are 100 ft. by 150 ft. in area, and three of them are provided with underdrains. The two drying beds are 50 ft. by 150 ft. in area. Tests indicate the sand drying beds will give four loadings per year and can be used only during the summer season. High construction costs and the very large area required would prohibit their use in Winnipeg.

To date no obnoxious odor has developed from the lagoons (holding digested and elutriated digested sludges). It appears that sludge in underdrained lagoons can be moved after 18 months, whereas sludge in lagoons not underdrained probably will require at least 24 months. However, it appears that underdrains are not economically justified: successful operation will depend on ability to decant or otherwise remove liquid from the lagoons. Freezing of liquid lines was encountered, and consideration should be given to sludge storage to permit less frequent discharges of sludge in larger quantities.

Disposal by Sanitary Fill

G. H. Richards, City Engineer, Brantford, Ont., presented a paper on the subject of "Sanitary Fill as a Method of Refuse Disposal."

Mr. Richards reviewed difficulties experienced by the City of Brantford in using various methods to solve its refuse disposal problem. Until 1940 open dumps, inadequately covered, were used; these bred rats, frequently burned, gave off dust and odors. A new dump more distantly located was made possible by changing from horse-drawn to truck collection and delivery, but this aroused new complaints.

In 1944, alternate sites for dumping and then an incinerator were considered — but popular objection to both proposals was violent. Disposal of refuse, it became evident, is possible in or near a residential area only when "you can convince the public that you can make a beautiful park out of an old gravel pit."

The author described the development and successful use of sanitary fill as a method of successful and economical disposal. He raised the questions — "Why hasn't it been adopted by all progressive communities? How is it that only three cities in Ontario are using this system?" His answer: "Sanitary fill never will take the place of incineration as a method of disposing of municipal refuse, but on the other hand it provides an excellent means of reclaiming waste land. In other words, the emphasis has been placed upon the wrong phase of this operation."

Programmers

I. G. Simmonds
Asst. Chem. Engr.
Ont. Health Dept.
Toronto, Ont.

R. G. Ferguson
Zoology Dept.
Univ. of Toronto
Toronto, Ont.

Guided Discussions

Pertinent and varied topics were reviewed in the "Guided Discussions"

which have become an outstanding feature of Institute meetings.

Subdivision Utility Financing

Under the chairmanship of GORDON H. BAKER, Engr., North York Township, Ont., the "Financing of Utility Subdivision Utilities" was discussed from the viewpoint of policy and practice.

Municipal Plumbing Code

NICOL MAC NICOL, Commr. of Works, Forest Hill, Ont., was chairman of a guided discussion on the topic "A Plumbing Code in Municipal Sanitation." Such a code has been approved by the Ontario authorities to take effect in May, 1953, as a "minimum code." Consideration was given to the desirability of a uniform code for all Canada, to the enforcement of local plumbing by-laws, and to various requirements and tests.

Sewer Maintenance

E. E. W. OKE, City Engineer, Waterloo, Ont., served as chairman of the discussion on "Sewer Cleaning and Maintenance." In this session subjects covered were: maximum distances between manholes as related to efficient sewer cleaning; methods used to insert bucket cables; frequency of cleaning catchbasins and pumps; and methods of catchbasin connection to mains.

Guided Discussions

Chairman	Chairman
E. E. W. Oke	*F. McArthur*
City Engr.	*Cons. Engr.*
Waterloo, Ont.	*Islington, Ont.*

Other Problems

F. MCARTHUR, Cons. Engr., Islington, Ont., was the chairman of the final discussion, "Miscellaneous Problems in Sanitation."

On the subject of difficulties resulting from detergents: foaming troubles apparently are not yet widespread in Canadian plants. Sprays and antifoam agents were discussed as corrective measures, but one member pointed out that oil might interfere with the efficiency of aeration units.

On the subject of septic tanks vs. small sewage treatment plants: Septic tank installations often prove so costly (for individual homes in large subdivisions) that sewers and "package" treatment plants are less costly. Where lots have wide frontages, the opposite is generally true.

On average costs of laying sewers: Transite pipe is coming into general use and is quite economical.

On refuse collection: cost, frequency, and disposal: garbage and refuse collection and disposal in Galt, Ont., costs a total of $4.65 per ton or $2.13 per capita per year. Household garbage grinders are forbidden in one Ontario municipality, but Provincial authorities see no objection to their use.

NEW WATER & SEWAGE REPORTS

Fourth Annual Report—Ohio River Valley Water Sanitation Comm. Edward J. Cleary, Executive Director and Chief Engineer. Dated Nov. 15, 1952 (Headquarters: 414 Walnut St., Cincinnati, Ohio).

This beautifully arranged and illustrated report presents in only 24 pages a clear concept of the Commission's program and progress. The content and presentation are designed to show in simplified form the many and varied elements included in a regional pollution abatement campaign.

Program goals and tasks are sharply delineated: What must be done; How the job is being tackled; and What has been done.

Under the heading, "How far the job is done" it is pointed out that all steps (investigations, hearings, setting requirements, and formal notice) have been taken on 182 miles of the 981 in the Ohio River, and investigations are partly completed on 301 miles. Investigations have been completed on 130 miles of the Wabash river. Municipal treatment status and industrial waste control are tabulated:

Municipal Treatment Status

	Cities	Population
Treatment provided	357	1,834,300
Construction stage	26	782,000
No treatment	970	6,667,700

Industrial Waste Control

Plants in operation	693
Under construction	42
Plans in preparation	150
Requiring attention	385

The report is able to point to one very notable achievement: a leveling off of stream pollution can now be noted in the territory covered. Within the past year, 22 new sewage plants were placed in operation and construction was started on 20 others in the Ohio Valley.

* * *

Report on the Collection, Treatment and Disposal of the Sewage of San Diego County, California. Board of Engineers, David H. Caldwell, Charles Gilman Hyde, A. M. Rawn (chairman). Dated September 2, 1952. (San Diego County Sewerage Survey, San Diego 10, Calif.)

A well-organized and comprehensive study of 515 pages, including photos, maps, diagrams and tabulations. The Board submits 10 recommendations for the San Diego Bay Area, and 22 for the North Coastal Sewerage Area.

The report recommends a plan for the construction of a primary-type treatment plant to serve the entire San Diego Bay Area, and that the city of San Diego construct and operate the facilities. Sanitation districts should be formed, purchase capacity rights in the system, and construct trunk sewers to the treatment plant. The existing treatment plants of the cities of Chula Vista, El Cajon, and San Diego should be converted to water reclamation plants.

For the North Coastal Area, eight county sanitation districts should be formed, three others should join in a joint treatment plant, and also two others should join for a similar plan. A Mountain-Desert Sewerage Area represents a separate entity with more limited needs.

The report is exceptionally complete and readable. In the event that the recommended projects are approved for construction, the information needed for preparing plans and specifications will be available.

Fluoridation Favored in Australia

A press report from Melbourne, Australia, indicates that fluoridation may soon become common water treatment practice "down under." The national health council has asked the federal government to make the addition of fluoride to Australia's water supplies compulsory.

Senior Author

Sludge Filtration Studies

The Effect on Filtration Rates of Sludge Mixtures and Conditioning Chemicals

by C. E. KEEFER,* *Deputy Sewerage Engineer, and* JOSEPH MEISEL, *Senior Chemist, Bureau of Sewers, Baltimore, Md.*

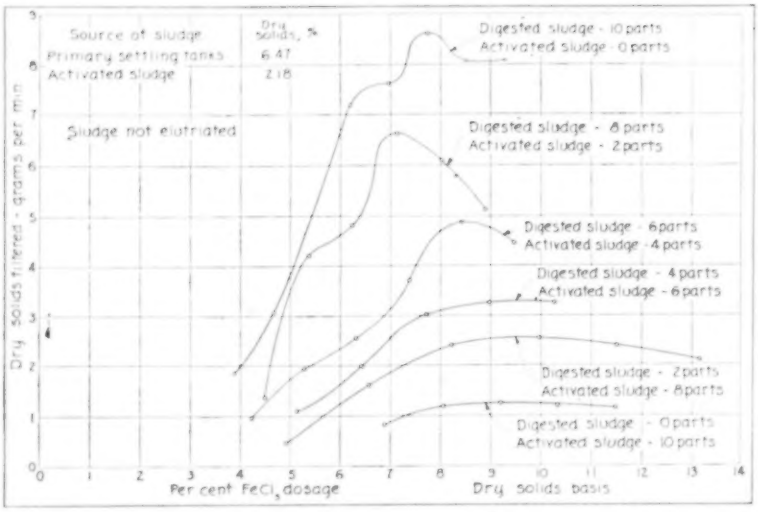
AT sewage treatment works where vacuum filters are used, the operator usually is confronted with filtering one type of sludge, or at the most a mixture of two types of sludge. The filtering of sludge at such installations is not always easy, and the problem becomes more complicated when the mixture includes three or four types of sludge. This is the situation at the Back River sewage-treatment works, serving Baltimore city, where a mixture of four types of sludge is digested, elutriated and dewatered on four vacuum filters with a surface area of 2,000 sq. ft. The mixture consists of primary settling-tank sludge, activated sludge, humus-tank sludge (following trickling filters) and secondary settling tank sludge resulting from the coagulation of sewage effluent with alum. The studies outlined in this paper were made in order to clarify some of the problems involved in filtering these sludges.

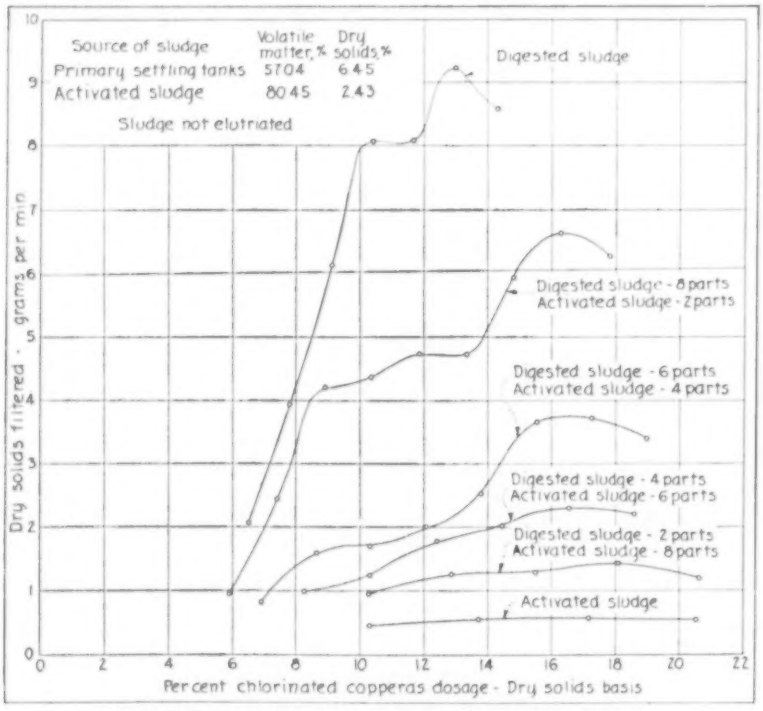
Method of Filtering Sludge

All filtration tests were made using a 9-cm. Buechner funnel in accordance with the method described by Genter[1]. Sufficient coagulant and water were added to 200 grams of the sludge to be filtered to bring the volume up to 220 ml. The sludge was poured on a No. 4 grade Whatman filter paper, which was retained in the Buechner funnel, and vacuum was applied, permitting filtrate to be sucked into a flask. When the sludge cake was sufficiently dry, the vacuum broke, the time was recorded, and the weight of the filter cake determined. The percentage of coagulant used and the weight of dry solids filtered per minute were determined.

Primary Settled Sludge and Raw Activated Sludge

At the present time the primary settling tank sludge and the activated sludge at the Back River


Source of sludge
Dry solids, %
Primary settling tanks 6.47
Activated sludge 2.18
Sludge not elutriated
Digested sludge - 10 parts
Activated sludge - 0 parts
Digested sludge - 8 parts
Activated sludge - 2 parts
Digested sludge - 6 parts
Activated sludge - 4 parts
Digested sludge - 4 parts
Activated sludge - 6 parts
Digested sludge - 2 parts
Activated sludge - 8 parts
Digested sludge - 0 parts
Activated sludge - 10 parts
Dry solids filtered - grams per min
Per cent FeCl3 dosage
Dry solids basis


Source of sludge
Volatile matter, %
Dry solids, %
Primary settling tanks 57.04 6.45
Activated sludge 80.45 2.43
Sludge not elutriated
Digested sludge
Digested sludge - 8 parts
Activated sludge - 2 parts
Digested sludge - 6 parts
Activated sludge - 4 parts
Digested sludge - 4 parts
Activated sludge - 6 parts
Digested sludge - 2 parts
Activated sludge - 8 parts
Activated sludge
Dry solids filtered - grams per min
Per cent chlorinated copperas dosage - Dry solids basis

MIXTURES of digested primary sludge and raw activated sludge
Fig. 1 (Above)—Filtration rates using ferric chloride for coagulation
Fig. 2 (Below)—Filtration rates using chlorinated copperas for coagulation

* Editorial Associate, *Water & Sewage Works.*

sewage treatment works are digested and then dewatered on vacuum filters. It is planned to heat dry the filter cake and sell it as a base for fertilizer. This material would have a higher nitrogen content and sale value if the activated sludge were not digested prior to filtration. Laboratory studies, therefore, were made to determine the effect on the filterability of the mixture of adding various quantities of raw activated sludge to digested primary tank sludge. The sludge mixtures, which were coagulated with ferric chloride, contained 0, 20, 40, 60, 80 and 100 per cent raw activated sludge on the wet basis.

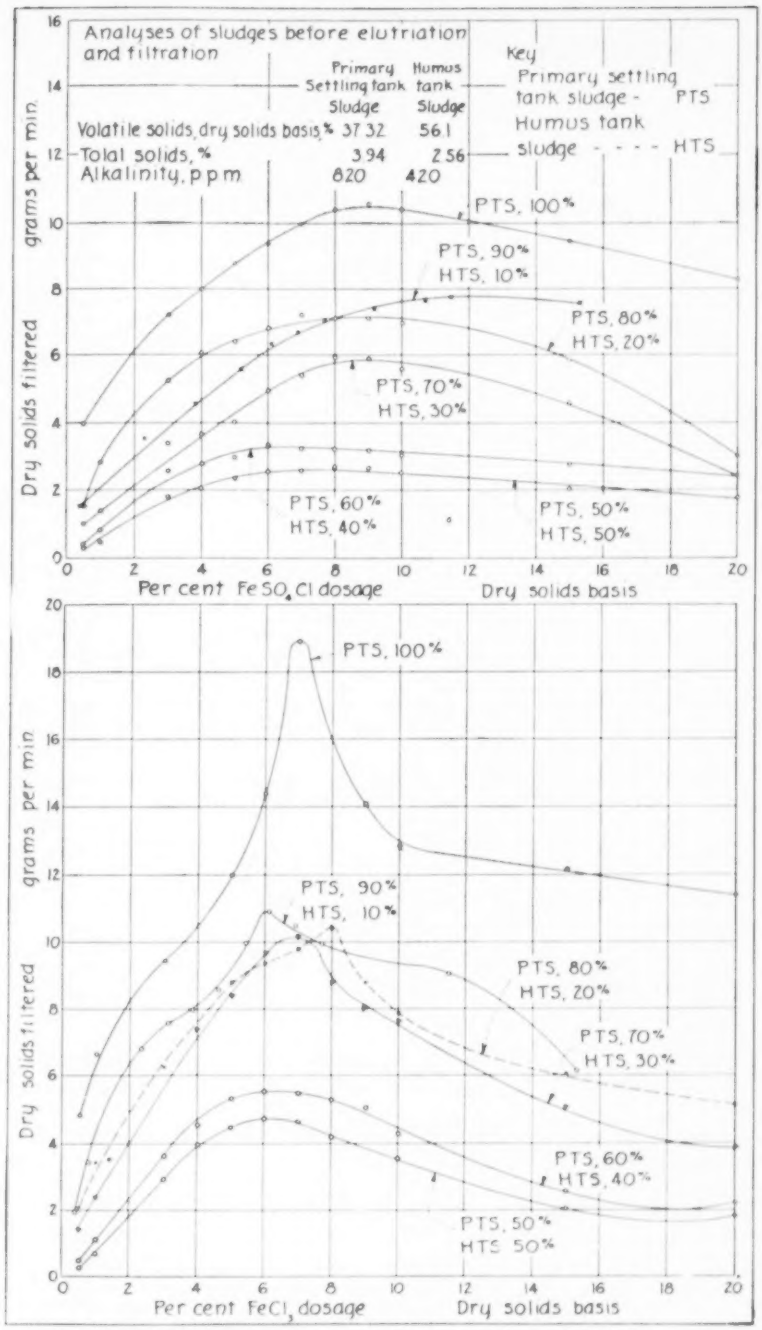
A number of filtration tests were made. Of these the results shown in Fig. 1 are typical. When using 7.0 per cent of ferric chloride based on dry sludge solids, the filtration rate of the digested sludge was about nine times greater than when filtering raw activated sludge. The rate of filtration decreased as the percentage of digested primary tank sludge in the mixture decreased.

Similar tests were conducted using chlorinated copperas (see Fig. 2). Larger doses of this coagulant were required than ferric chloride. Even when using large amounts of chlorinated copperas, the yield of dry solids was less than when using ferric chloride. For example, when filtering activated sludge alone the addition of 9 lb. of ferric chloride per 100 lb. of dry sludge solids resulted in a filtered cake yield of 1.23 grams of dry solids per min.; the use of 14 lb. of chlorinated copperas gave a cake yield of only 0.54 grams per min. As was the case when using ferric chloride, the greater the amount of activated sludge added to the digested primary tank sludge, the lower was the cake yield.

Digested Primary Sludge and Raw Humus Sludge

Humus tank sludge is like activated sludge in that digestion reduces its nitrogen content. It was of interest to learn to what extent adding raw humus tank sludge to digested primary settling tank sludge would affect the filterability of the latter material.

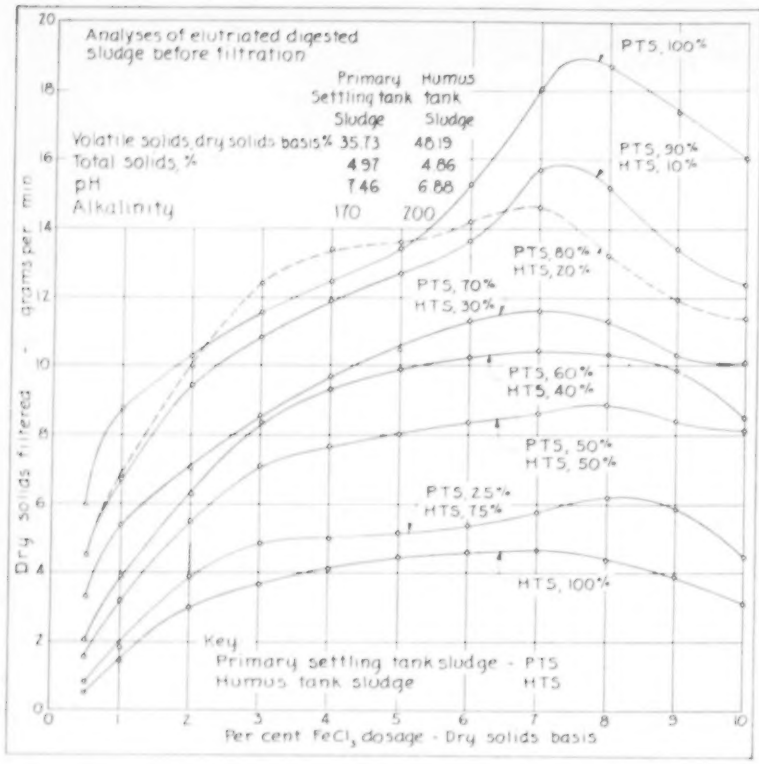
Mixtures containing various percentages of digested primary settling tank and raw humus tank sludge were elutriated with 5 volumes of tap water, coagulated with (1) ferric chloride and (2) chlorinated copperas and then filtered (see Fig. 3). The best results were obtained when digested primary sludge alone was filtered, using ferric chloride as a coagulant. The addition of increasing quantities of humus-tank sludge to the digested primary sludge reduced the cake yield. For example, using 4 lb. of ferric chloride per 100 lb. of dry sludge solids gave a cake yield of 10.65 grams of dry solids per min. when filtering digested primary settling-tank sludge, and 3.90 grams per min. when filtering a mixture containing equal parts of primary settling tank sludge and raw humus tank sludge, a reduction of approximately 63 per cent.


Analyses of sludges before elutriation and filtration
Primary Settling tank Sludge
Humus tank Sludge
Volatile solids, dry solids basis, % 37.32 56.1
Total solids, % 3.94 2.56
Alkalinity, p p m 820 420
Key
Primary settling tank sludge - PTS
Humus tank sludge - - - - HTS
PTS, 100%
PTS, 90% HTS, 10%
PTS, 80% HTS, 20%
PTS, 70% HTS, 30%
PTS, 60% HTS, 40%
PTS, 50% HTS, 50%
Dry solids filtered, grams per min.
Per cent Fe SO4 Cl dosage
Dry solids basis
Per cent FeCl3 dosage

MIXTURES of digested primary sludge and raw humus tank sludge

Fig. 3—Filtration rates (above) using chlorinated copperas and (below) using ferric chloride for coagulation

As was to be expected, chlorinated copperas was much less effective than ferric chloride. When filtering a mixture of equal quantities of digested primary settling tank sludge and raw humus tank sludge, the use of 4 lb. of chlorinated copperas per 100 lb. of dry sludge solids gave a cake output 2.1 grams per min.


Analyses of elutriated digested sludge before filtration
Primary Settling tank Sludge
Humus tank Sludge
Volatile solids, dry solids basis % 35.73 48.19
Total solids, % 4.97 4.86
pH 7.46 6.88
Alkalinity 170 700
PTS, 100%
PTS, 90% HTS, 10%
PTS, 80% HTS, 20%
PTS, 70% HTS, 30%
PTS, 60% HTS, 40%
PTS, 50% HTS, 50%
PTS, 25% HTS, 75%
HTS, 100%
Key
Primary settling tank sludge - PTS
Humus tank sludge HTS
Dry solids filtered - grams per min.
Per cent FeCl3 dosage - Dry solids basis

ELUTRIATED mixtures of digested primary sludge and digested humus tank sludge
Fig. 4—Filtration rates using ferric chloride for coagulation

of dry solids, whereas the same dosage of ferric chloride resulted in a cake output of 3.9 grams per minute, an increase of about 85 per cent.

Mixtures of Digested Primary Sludge and Digested Humus Sludge

Varying quantities of digested humus tank sludge were added to digested primary tank sludge. Each of the mixtures was then elutriated with five volumes of tap water, coagulated with varying amounts of ferric chloride and filtered. The results are shown in Fig. 4. In general the greatest output was obtained when the primary tank sludge contained no humus tank sludge. With the use of 2.0 per cent (dry sludge solids basis) of ferric chloride, the filtration rate was 2.95 grams of dry solids per min. when filtering digested humus tank sludge alone, and 10.24 grams per min. when filtering primary tank sludge alone, an increase of approximately 350 per cent.

When a comparison is made between filtering (1) mixtures of digested primary settling tank sludge and *raw* humus tank sludge (see Fig. 3) and (2) mixtures of digested primary settling tank sludge and *digested* humus tank sludge, a greater cake output was obtained when filtering the latter material. A mixture of equal parts of digested primary tank sludge and *raw* humus tank sludge resulted in a cake yield of 4.7 grams of dry solids per min. with a ferric chloride dosage of 6.0 per cent (dry sludge solids basis); when filtering a mixture of equal parts of digested primary tank sludge and *digested* humus tank sludge, the cake output was 8.35 grams of dry solids per minute with the same dosage of coagulant.

Elutriated Digested Sludge and Type of Coagulant

Studies and tests extending over a period of twenty years have indicated ferric chloride to be a more effective coagulant than chlorinated copperas. The reason is that the sulfate ion is bivalent and is more effective than the monovalent chlorion in increasing the negative potential of colloidal sludge particles. This bivalent anion acts more strongly against the discharging effect of the trivalent ferric ions.

Although ferric chloride is more effective than chlorinated copperas as a coagulant its cost is much greater. Ferric chloride delivered in Baltimore costs $81.80 per ton on the anhydrous basis, whereas the cost of making chlorinated copperas at the Back River sewage-treatment works amounts to approximately $24.50 per ton.

It was considered of interest to determine the effectiveness of these two chemicals as a coagulant when mixed in various proportions. Tests were made by adding mixtures containing various percentages of ferric chloride and chlorinated copperas to elutriated digested primary settling tank sludge and then filtering the coagulated mixture (see Fig. 5). Chlorinated copperas was added to ferric chloride so that the mixtures contained 0, 20, 40, 60, 80 and 100 per cent ferric chloride. When the percentage of chlorinated copperas in the mixture was increased the rate of filtration decreased. As the dosage of conditioner was increased, ferric chloride gave a correspondingly greater cake output than when chlorinated copperas was used. For example, increasing the ferric chloride dosage from 1 to 6 per cent based on dry sludge solids resulted in increasing the cake output 11.8 grams per min. of dry solids; a similar increase in chlorinated copperas dosage resulted in an increase in cake output of 7.1 grams per min. of dry solids.

At a plant where chlorinated copperas is used as a coagulant, it may be desirable under certain circumstances to use a mixture of ferric chloride and chlorinated copperas to increase the filter-cake output.

Ferric Chloride and Lime for Coagulation

During the early years of the operation of the vacuum filters at the Back River sewage treatment works, the average filter-cake output varied

Table I
Output of Vacuum Filters
Back River Sewage Works, Baltimore, Md., Showing Effect of Percentage of Activated and Humus Tank Sludges in Primary Settling Tank Sludge

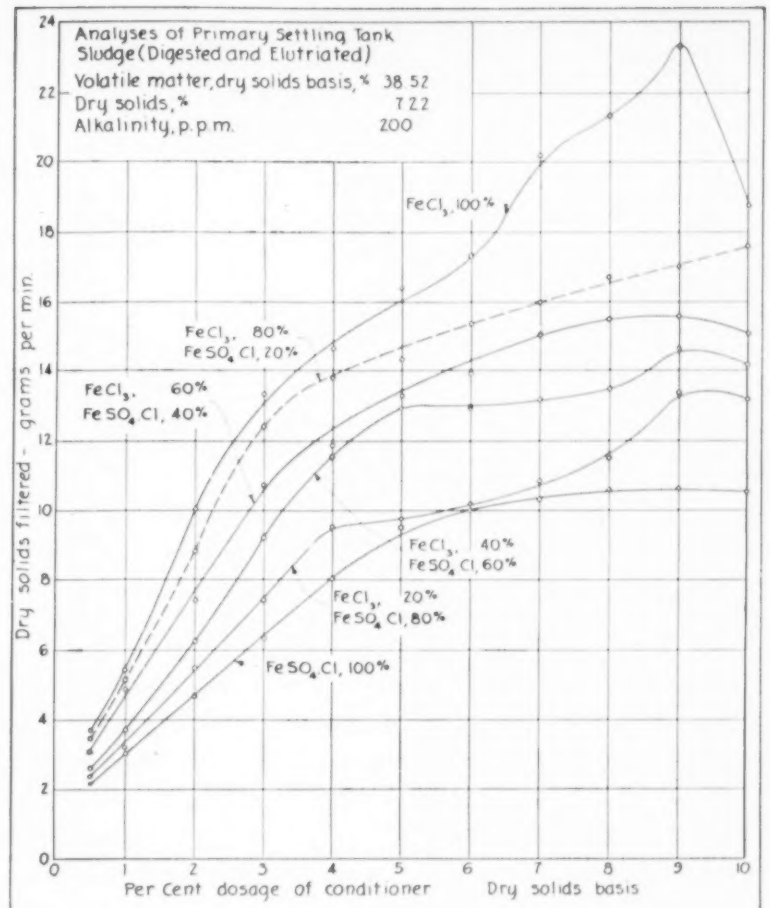
Year	Amount of activated and humus tank sludges in total sludge volume (%)	Rate of sludge filtration (lb. per sq. ft. per hr.)	Alkalinity of elutriated sludge (p.p.m.)	Solids in sludge (%)
1941	9.75	4.77	486	5.1
1942	4.78	4.49	515	4.9
1950	20.7	2.86	344	5.7
1951	33.8	1.87	177	6.6

from approximately 4.5 to 5.0 lb. of dry solids per sq. ft. of filter area per hr. Within the past two years the percentage of activated and humus tank sludge in the primary settling tank sludge has increased materially and, at the same time, the rate of sludge cake output has decreased. For example, in 1941 (Table 1) when the percentage of activated and humus tank sludges in the sludge that was being filtered amounted to 9.75 per cent, the average rate of sludge filtration was 4.77 lb. of dry solids per sq. ft. per hr. In 1951 the sludge contained 33.8 per cent of these two sludges, and the cake output had decreased to 1.87 lb. per sq. ft. per hr. This reduction in output occured even though the sludge had a lower alkalinity and a higher solid content than that of the sludge filtered in 1941.

In order to see if this output could be increased, filtration tests were made in the laboratory using ferric chloride and lime as coagulants. The sludge to be filtered had been digested and consisted of a mixture of primary, activated and humus tank sludges. Prior to filtering the sludge was elutriated with 5 volumes of tap water. The volatile content of the sludge on the dry basis was 50.3 per cent, and the alkalinity was 100 p.p.m. The results of the filtration tests are given in Fig. 6.

It is apparent that the use of lime materially increased the cake output. For example, using 4 per cent of lime and 2 per cent of ferric chloride (percentages are on dry sludge solids) resulted in a cake output of 1.0 gram of dry solids per min., whereas the use of 2 per cent of ferric chloride alone gave a cake yield of 0.37 grams of dry solids per minute. To produce an output of 1.0 gram per minute without the use of lime 4.8 per cent of ferric chloride was required.

As ferric chloride is over 5 times more expensive than lime, it is more economical to use ferric chloride and lime together than to use ferric chloride alone. Fig. 7 indicates the relationship between the amount of dry solids filtered per hour and the cost of (1) ferric chloride alone and (2) ferric chloride and lime. The results shown in this figure are based on the filtration rates given in Figure 6. Anhydrous ferric chloride was assumed to cost $81.80 per ton and lime $15.11 per ton. Fig. 7 indicates that with the same expenditure for coagulants per unit of time the dry-solid output can be increased by using lime with ferric chloride. For example, with an expenditure of 30 x 10^{-3} cents per hr., the dry solids


Analyses of Primary Settling Tank Sludge (Digested and Elutriated)
Volatile matter, dry solids basis, % 38.52
Dry solids, % 7.22
Alkalinity, p.p.m. 200
FeCl3, 100%
FeCl3, 80% FeSO4Cl, 20%
FeCl3, 60% FeSO4Cl, 40%
FeCl3, 40% FeSO4Cl, 60%
FeCl3, 20% FeSO4Cl, 80%
FeSO4Cl, 100%
Dry solids filtered - grams per min.
Per Cent dosage of conditioner Dry solids basis

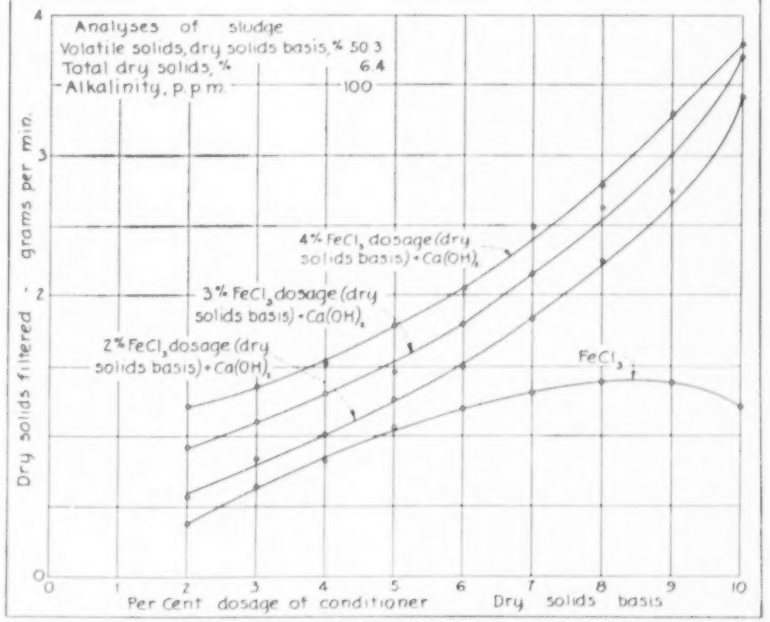

Analyses of sludge
Volatile solids, dry solids basis, % 50.3
Total dry solids, % 6.4
Alkalinity, p.p.m. 100
4% FeCl3 dosage (dry solids basis) + Ca(OH)2
3% FeCl3 dosage (dry solids basis) + Ca(OH)2
2% FeCl3 dosage (dry solids basis) + Ca(OH)2
FeCl3
Dry solids filtered - grams per min.
Per Cent dosage of conditioner Dry solids basis

Fig 5 (Above)—ELUTRIATED digested primary sludge
Filtration rates using mixtures of ferric chloride and chlorinated copperas for coagulation
Fig. 6 (Below)—DIGESTED and elutriated mixture of primary, activated, and humus tank sludges
Filtration rates using ferric chloride and lime for coagulation

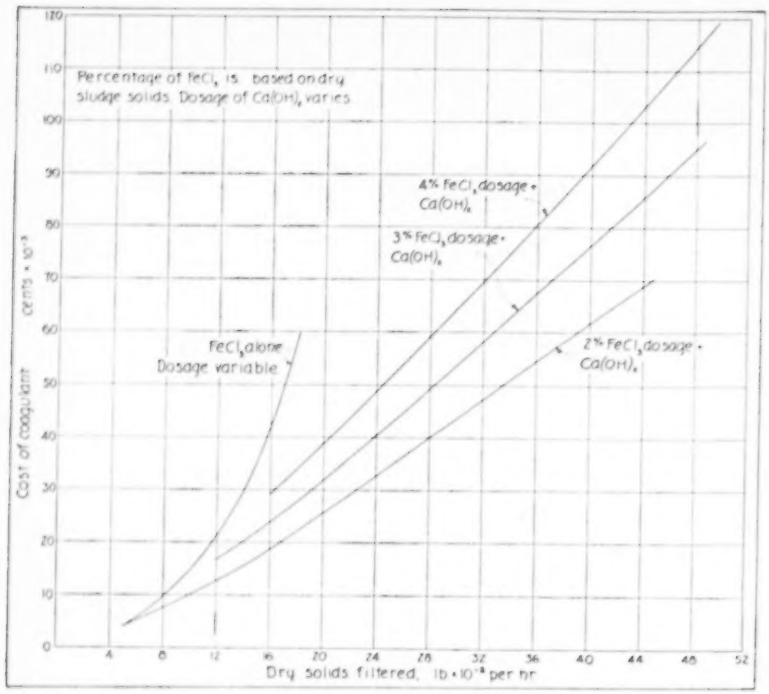

Percentage of FeCl3 is based on dry sludge solids. Dosage of Ca(OH)2 varies
4% FeCl3 dosage + Ca(OH)2
3% FeCl3 dosage + Ca(OH)2
2% FeCl3 dosage + Ca(OH)2
FeCl3 alone Dosage variable
Cost of coagulant cents × 10⁻³
Dry solids filtered, lb × 10⁻³ per hr

Fig. 7—RELATIONSHIP between cost of coagulants and filtration rates

output can be increased from 14.2 x 10^{-3} lb. per hr. to 22.4 x 10^{-3} lb. per hr. by using ferric chloride and lime instead of ferric chloride alone.

Conclusions

Although the following conclusions relate to conditions in Baltimore, it is believed that they most likely have a considerably wider applicability.

1. The addition either of raw activated or raw humus tank sludge to digested primary settling tank sludge materially reduced filtration rates in laboratory studies. Higher rates of filtration were obtained when digested humus tank sludge was added to digested primary settling tank sludge as compared with the addition of raw humus tank sludge.
2. Without exception ferric chloride was a more effective coagulant, its use resulting in a higher cake output than that obtained with chlorinated copperas. Where the price differential between these two chemicals is sufficiently great, it may be more economical to use chlorinated copperas as the coagulant. Using a mixture of ferric chloride and chlorinated copperas as the coagulant resulted in a decrease in filter cake output. This decrease became greater as larger amounts of chlorinated copperas were used.
3. It was more economical to use ferric chloride and lime as coagulants than to use ferric chloride alone.

Acknowledgments

The Back River sewage treatment works is under the general direction of P. L. Holland, director, Department of Public Works, and John J. Hunt, sewage engineer. Dr. Abel Wolman is consultant to the Department of Public Works. R. J. Trautman, principal associate engineer, has direct supervision of the sewage works and Paul L. Smith is plant superintendent.

References

1. Genter, A. L., "Adsorption and Flocculation as Applied to Sewage Sludges." *Sewage Works Jour.* 6, 4, 689 (July, 1934).

Morse Returns to Indianapolis Water Co. as President

Howard S. Morse, who, on Dec. 31, 1949 retired from active duty as executive vice-president of the Indianapolis Water Co., now returns to the Company as its president.

During his period of retirement from active duty Mr. Morse continued to serve as a director of the Company, while also serving his city as president of the Board of Sanitary Commissioners of Indianapolis.

Mr. Morse, a graduate of the Mass. Institute of Technology, became manager of the Indianapolis Water Co. in 1925; was elected vice-president and general manager in 1938 and executive vice-president in 1949.

A. O. Norris, formerly manager of the Birmingham (Ala.) Water Co. who succeeded Mr. Morse as executive vice-president of the Indianapolis Water Co., continues in this capacity as well as that of director of the Company.

Turbine Pump Makers Discuss Underground Water sources

"Underground Water Sources, their conservation, protection and use" was the principal topic of discussion at the semi-annual meeting of the National Assn. of Vertical Turbine Pump Manufacturers, held recently at the Roosevelt Hotel, New Orleans, La. The Association is composed of the majority of leading manufacturers of vertical turbine pumps, which are widely applied in the development of underground water supplies for municipalities, industry and agricultural irrigation.

Leland C. Kimball, Sales Mgr., Byron Jackson Co., Los Angeles, and retiring President of the Association, reported on the activities of the past year, and papers on topics of interest to the pump industry were presented by W. C. Mumford, Manager, Vertical Turbine Pump Div., Worthington Corporation, Succasunna, N.J.; G. F. Twist, General Manager, Peerless Pump Div., Food Machinery and Chemical Corp.; Charles E. Wilson, honorary director of the Association; T. E. Woodruff, Manager, Pump Dept., Fairbanks Morse & Company, Chicago, and H. E. Carloss, V. P., Deming Co., Salem, Ohio.

Election of Association officers for the ensuing year of 1953 was also held. The new Association officers are: President, G. F. Twist, Peerless Pump Div., Food Machinery and Chemical Corp.; Vice-President, T. E. Woodruff, Fairbanks Morse & Co., Chicago, and Secretary, B. A. Tucker, Peerless Pump Div., Food Machinery and Chemical Corp., Los Angeles.

Activated Silica Treatment of Raw and Waste Waters*

Municipal and Industrial Installations Demonstrate the Economy of Improved Flocculation

by A. B. MIDDLETON, *Chemical Staff, Philadelphia Quartz Co. Philadelphia, Pa.*

ACCORDING to recent reports the cost of disposal of industrial wastes is from 9 to 12 billion dollars annually in the United States, and this activity has become more important than the disposal of sanitary sewage[1]. The use of an activated silica sol as a coagulant aid in solving problems connected with processing raw waters and industrial wastes has been expanding steadily. In many cases, water treatment plant capacities have been increased, faster filtration is obtained, and normal chemical dosages have been so reduced that there is generally a decreased overall cost in the chemical treatment of water.

What is "Activated Silica"?

The term "activated silica" designates a negatively charged colloidal particle formed by the reaction of a dilute sodium silicate solution with a dilute solution of an acidic material. This process generally involves the dilution of a liquid sodium silicate containing about 8.9 per cent Na_2O and 28.7 per cent SiO_2 and having a gravity of 41.0° Baumé. The silicate is diluted to about 2 per cent SiO_2 and an acidic material such as sulfuric acid, ammonium sulfate, chlorine, sodium bicarbonate, etc. is added to bring the SiO_2 concentration down to about 1.5 per cent. The solution is aged for 1.5 to 2 hours, at the low concentration of silica, in order to permit the growth of the silica formation. Further growth is finally arrested by the addition of water to bring the SiO_2 concentration down to about 1 per cent or less; this step results in increased stability of the sol.

Types of Silica Sols

The various types of activated silica sols have been designated in accordance with the different neutralizing agents employed to prepare them. Thus the sol utilizing sulfuric acid has been called the Baylis sol[4] because J. R. Baylis of the Chicago Water Department did the original work in developing this type of activated silica. The process using ammonium sulfate to react with the silicate is designated as N-Sol-A[11]; in this reaction the ammonia present is available for chloramine disinfection. The N-Sol-B[2] method uses alum for neutralization, while N-Sol-D uses sodium bicarbonate for activation. The latter method is generally used where the ammonia produced in the N-Sol-A process is not desired, or where it would be detrimental to the various non-ferrous metals employed in boiler construction. The N-Sol-C[10] method, using chlorine for activation, is of particular interest to most municipalities since the chlorine used can also serve for disinfection.

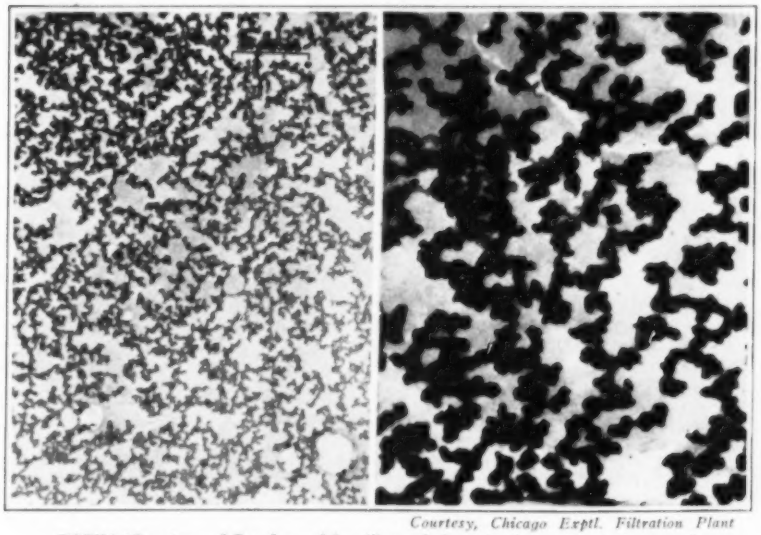
These various types of activated silica sols can be prepared either by batch methods or by continuous preparation. Wallace and Tiernan Co., Inc., recently developed a unit for the preparation of this sol[9] with the Philadelphia Quartz Co. assisting in the development. This unit will eliminate the need for aging tanks, and will make available an easily installed, efficient means of applying an activated silica sol. The unit has undergone extensive plant tests and should shortly be available. The Omega Machine Division of Builders Iron Foundry, Providence, R.I., also has developed a unit for the continuous preparation of N-Sol-C.

Operating Suggestions

In considering the design of water or waste treatment installations which are to utilize activated silica, there are several suggestions which may be of assistance. One of these involves flexibility in the location of the lines feeding the coagulant and coagulant aid to the system. In some instances best results are obtained when alum is added ahead of the silica sol. This is frequently the case when color removal is of primary interest. When turbidity is the major problem, addition of the silica sol ahead of the alum is frequently most beneficial. Where conditions are variable, flexibility in the feeding system can be most helpful.

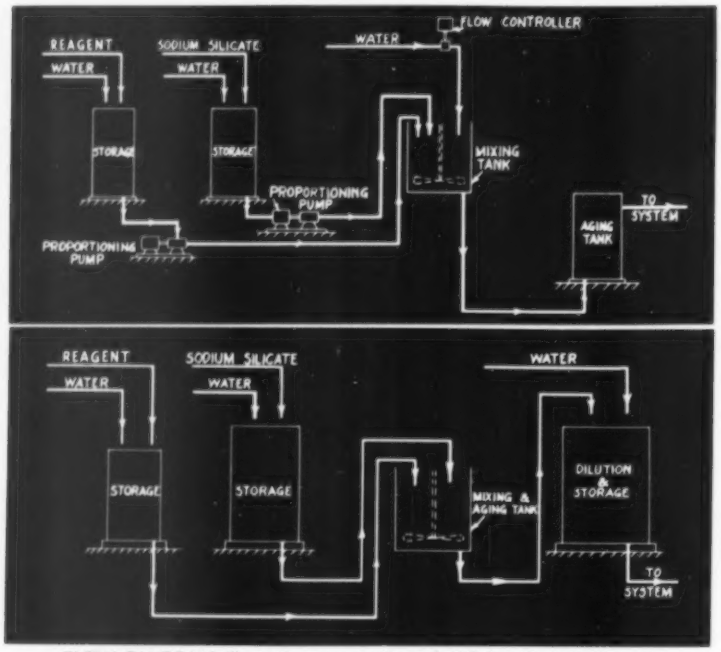
Another recommendation involves the use of Anthrafilt or large size sand (of 0.75 mm diameter effective size) in the filter units to make possible longer filter runs[11]. The use of rotary surface wash is also very helpful in maintaining filter efficiency when using activated silica sols. In plants employing activated silica with 0.7 mm sand, Baylis[6] has advocated filter design employing a rate of 4 gal. per min. per sq. ft.

* A paper presented at the Second Annual Conference on Sanitary Engineering, Lawrence, Kan., and released for publication in *Water & Sewage Works*.



Courtesy, Chicago Exptl. Filtration Plant

FIBRILLAR nature of floc formed by silica sol shows in these photo micrographs
(Magnifications: left 4,400x; right 14,850x)



FLOW DIAGRAM illustrating preparation of N-Sol activated silica sol
Upper—Continuous system, Lower—Batch system

This rate has been achieved without any sacrifice in the bacteriological quality of the water.

Installations for Water Treatment

Numerous municipalities currently are employing activated silica sol in their water treatment plants. Among these are Kansas City, Kan., Chicago, Ill., Miami, Fla., Houma, La., New Kensington, Pa., Vero Beach, Fla., and Orlando, Fla., and many other municipal and industrial water plants.

In connection with the plans for the Miami, Fla. plant, Prof. A. P. Black (in his lecture at the Short School for Water Work Operators at the Georgia Institute of Technology, Sept. 1947) said:

"The new 80 million gallon softening plant of the City of Miami is being designed to employ activated silica as the only coagulant, although facilities will be provided for feeding alum to anticipate possible changes in water quality. In the case of this particular water, 2 to 4 ppm of activated silica yields better results than a dosage of 3 grains per gallon of alum. While activated silica used in conjunction with another coagulant should properly be called a coagulant aid, the time has come to recognize that it may and often does itself act as a coagulant in the truest sense of the word."

The plant at Miami is rather unusual in that diesel exhaust gas containing 4 to 5 per cent CO_2 gas is used for activation. According to our latest reports, very good results are being obtained by applying 1.5 ppm. SiO_2.

Details of experience in the use of activated silica in a municipal water plant at Houma, La.,[12] are worthy of review. The population of Houma increased considerably and the water plant was faced with the need for increased capacity. The plant includes conventional mixing and settling basins (capacity of 1 mgd) and a recently installed up-flow type of unit (capacity 2 mgd). As the result of applying N-Sol-A to the water being treated, Mr. Hazlip finds that:

"1. Rate of flow both in the basins and in the up-flow unit has been increased.

"2. Basins are operated for longer periods between washings with only slight increase in wash water.

"3. A high chlorine residual is maintained without added cost.

"4. There has been a reduction of all chemicals used, with the exception of carbon and chlorine.

"5. A reduction in chemical cost of 30 to 50 per cent was achieved.

"6. The quality of water, taste, sterility and sparkle were improved."

The data in Tables 1 and 2 show the details of a three month run at the Houma plant using activated silica in comparison with the former method of coagulation.

Water Treatment Abroad

Experiences abroad have shown the benefits that can be derived from the use of activated silica sol. The Warrington Corp. plant in England, treating River Mersey water, had a maximum capacity of 4.5 mgd when using alum followed by lime for coagulation. Since adoption of activated silica, the maximum capacity of the plant has been raised to 8 mgd.[19]

The National Institute of Sanitary Work in Venezuela has designed many water plants in that country which take advantage of activated silica coagulation. J. R. Hurtado, in a paper[3] delivered before the 71st Annual Meeting of the A.W.W.A., described many of these plants. In Venezuela, considerable success has followed the use of N-Sol-B, which is the alum activated silica sol. This is in direct contrast to experience in the U.S., where the use of alum for activation has not been too successful.

Waste Water Treatment

Some work has been done on the treatment of sewage with activated silica. H. Gladys Swope[16] has reported on her studies at Waukegan, Ill., which indicate a decrease in suspended solids, B.O.D. and turbidity when 1.5 gpg of alum were used along with 0.2 gpg of silica as SiO_2. At Grand Forks, N.D.,[4] the use of 10 ppm. SiO_2 made possible a 40 per cent reduction in the amount of alum necessary to produce good coagulation of sewage. These iso-

Table 1
CHEMICALS USED

	Gal. per day Filtered	Rate gpm	Wash Water	Alum gpg	Carbon ppm	Chlorine ppm	Approx. Cost/mg
Old Method	1,208,556	1000	3.79%	4.80	2.61	0.79	41.41
Activated Silica Sol.	1,309,271	1200	4.16%	3.47	2.93	1.30	20.72

Table 2
COMPARATIVE CHEMICAL ANALYSES OF WATER

	Raw Water					Finished Water				
	Color	Turbid.	NaCl	pH	Hardness	Color	pH	Hard.	Cl. Retnd.	Alk.
Old Method	78.6	88.4	37.2	7.2	88.7	8.7	8.9	110.6	0.36	49.2
Activated Silica Sol.	69.2	60.4	63.1	7.6	125.3	9.2	8.4	119.4	0.69	41.2

lated cases indicate possibilities of using activated silica in sewage treatment. Actually there has so far been little commercial use of N-Sols in sewage treatment practice.

The present national emphasis on the abatement of stream pollution by industrial wastes has brought into prominence the possibilities of activated silica sol as a coagulant aid. In treating refinery wastes, Roy Weston and co-workers (in a paper entitled "Coagulation of Refinery Wastes Using Twin Pilot Plant Units," presented before the 9th Annual Water Conference of the Engineers' Society of Western Pennsylvania) gave the results of much experimental work with activated silica. With both conventional and up-flow types of equipment, the throughput rate was doubled without loss of efficiency when silica sol was used as a coagulant aid. The test work showed definitely that chemical coagulation was a practical method of treating refinery wastes.

The Santa Fe Railway[1] had been notified to clean up its discharge into the Los Angeles River, and met the problem by using a unit employing diffused air flotation. The waste consisted primarily of free and emulsified oil. By use of activated silica sol and alum, the oil was reduced from 5000 to less than 10 ppm, and suspended solids were reduced from 7000 ppm to 26 ppm.

N. A. D'Arcy[7] has described the use of activated silica by a large California refinery in which oil has been reduced to 5 ppm in its effluent. Trials are being made toward possible reuse of this effluent in the refinery cooling system.

In treating the effluent from a metal finishing plant, the New Departure Div., General Motors Corp., Sandusky, Ohio, employs a clarifier of the up-flow type. In this unit, the use of activated silica broadens the effective pH range of coagulation and is further helpful in that it increases sludge compaction.

The paper industry was one of the first to accept effluent treatment. Use of equipment such as the Sveen-Pedersen save-all* to treat white water has been instrumental in saving many tons of fiber which normally was wasted and caused stream pollution. A. I. Barry[3] has discussed the use of diffused air flotation in many paper mill installations. Effluents from one paper board mill using this method have contained less than 0.3 lb. per 1000 gal., and the reclaimed fiber at a consistency of 3.0 per cent can be reused.

The results of much work done by the Atomic Energy Commission,

INDUSTRIAL water treatment—an oil refinery where activated silica is used for conditioning raw water

treating radioactive wastes both at Los Alamos and at Oak Ridge,[12, 13] have been published. In treating laundry wastes of Los Alamos (where complexing agents such as the phosphates were present), pH values approaching 12 were necessary; activated silica was used in the coagulation procedure to secure satisfactory flocculation.

Activated Silica Cost Data

The commonly used figures for approximating the cost of silica sol application are 35 to 50 cents per part per million for each million gallons of water treated. H. F. Bruner (in a discussion at the Water and Sewage Work school at Kansas Univ., June, 1950) described some cost factors involved at the Kansas City, Kan., water works, and indicated that in coagulation 1 pound of SiO_2 is considered equivalent to 10 pounds of alum. A recent installation in an Eastern steel mill showed almost a 50 per cent reduction in water treating costs when activated silica sol treatment was started. This resulted from complete elimination of the lime dosage and reduction of the alum dosage from 4 gpg to 1 gpg. In figures previously quoted, Hazlip (at Houma, La.) indicated the cost per million gallons of water treated was reduced from $41.41 to $20.72.

In treating industrial waste effluents dosages are apt to run considerably higher than those employed in normal raw water treatment. D'Arcy[7] estimates a cost of $.80 for chemicals for every 31,000 gallons of oil refinery waste treated in an air flotation unit. Treatment of radioactive wastes are indicated to have run as high as a cost of $8,000 per million gallons.

Summary

The development of a fast forming, dense, rapid settling floc under varying conditions of temperature and pH is the primary advantage to be obtained by the use of the N-Sols. The demonstrated advantages of activated silica sols have more than justified their laboratory promise. With new developments in methods of application, more industrial firms, municipalities and design engineers will desire to utilize the advantages made possible by their use.

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A.W.W.A. Board Actions

Maffitt New Vice-President; Kerslake Diven Medalist; Moore Goodell Prize Winner; LaDue and Newsom Made Honorary Members.

ALL but one of the 40 members of the A.W.W.A. Board met in New York on Jan. 18-20 to choose officers for the ensuing year, make awards, elect two new honorary members and transact the business of the Association.

One of the first orders of business was the choice of DALE F. MAFFIT, manager of the Des Moines, Iowa, water works, as vice-president designate. Vice President MORRISON B. CUNNINGHAM, Supt. & Engr. of the Water & Sewage Departments of Oklahoma City, was designated president to succeed CHAS. A. CAPEN, Chief Engr. of the North Jersey Water Supply Comm. WM. W. BRUSH, Editor of *Water Works Engineering* was chosen treasurer for his 27th successive term in this office. All of the new and re-elected officers take office at the close of the 1953 Convention in Grand Rapids, Mich., May 10-15.

Honors and Awards

Two members were elevated to the grade of Honorary Membership in recognition of conspicuous service to the Association and for their professional accomplishments. These were WENDELL R. LADUE, Supt. & Engr., Dept. of Water & Sewage, Akron, Ohio; REEVES NEWSOM, Village Mgr., Scarsdale, N.Y.

JAMES E. KERSLAKE, Supt. of Purification at Milwaukee, was voted the Diven Medal, which is awarded "that member who has rendered the most outstanding service to the Association during the year." He was cited for his work as coordinator in the preparation of specifications covering chemicals used in water treatment.

EDWARD W. MOORE, Prof. of Sanitary Chemistry at Harvard Univ. was awarded the Goodell Prize for his paper—"The Precision of Microscopic Counts of Plankton in Water"—which was published in the March, 1952, issue of the A.W.W.A. Journal and rated the outstanding Journal paper of the year. Two other papers were also highly evaluated by the Committee—namely, "Calculation of Effects of Temperature on pH, Free CO_2 and the Three Forms of Alkalinity" by JOHN F. DYE of Lansing, Mich., in the April, 1952, *Journal* and "Intakes on Variable Streams" by VANCE LISCHER and HERBERT HARTUNG of St. Louis, Mo., in the October, 1952, *Journal*. The Committee noted that papers appearing in the November and December, 1952, *Journals* did not receive consideration since the year for judging papers is that from October through October of succeeding years.

At this writing most of this issue has already gone to press. In order to avoid a full month's delay in presenting these "A.W.W.A. Board Actions," the editor's page is being utilized for the purpose. This explains the unusual location of the news portion of the report. The report will be completed in our March issue.—Editor

Nominees*

For President	For Vice-President
M. B. Cunningham	*Dale L. Maffitt*
Oklahoma City, Okla.	*Des Moines, Iowa*

Cup Winning Sections

The NEBRASKA SECTION was declared winner of the Hill Membership Cup for having made the best gain in membership during the year 1952. Runner-up sections were the Kansas, the Rocky Mountain and the Southwest Sections.

[Since as a Section grows in membership the difficulty of winning the Hill Cup becomes the greater, the performance of the rapidly growing Southwest Section, now second largest in the Association, is deserving of more than "honorable mention."—Ed.]

The CUBAN SECTION was again declared winner of the Henshaw Cup. This prize goes to that Section which has the highest per cent of its active members in attendance at its annual meetings. Runners-up were the Montana and Ala.-Mississippi Sections.

The CALIFORNIA SECTION, with 1012 members, continues to take back home the coveted Old Oaken Bucket which is the prize awarded that Section with the largest number of members. The runner-up Sections were the Southwest (729 members) and the New York (725 members) Sections.

[The Southwesterners boasted that they were out to oust the New York Section from No. 2 position in membership and they have done just that. Next on their list, so they say, is the robust California Section.—Ed.]

* Note: The Nominating Committee of the Board is comprised of only those elected directors sent to the Board by the several Sections. The Committee chooses a slate of officers which is presented to the Association membership as Official Nominees. If the membership at large of A.W.W.A. (25 or more active members) places no other names in nomination as contenders prior to March 1st, the Official Nominees automatically become "Officers Designate" on this date at high noon. They take office at the close of the next Annual Meeting of the Association.

Jas. E. Kerslake
Milwaukee, Wis.
Diven Medal

Edw. W. Moore
Cambridge, Mass.
Goodell Prize

Wendell R. LaDue
Akron, Ohio
Honorary Member

Reeves Newsom
Scarsdale, N.Y.
Honorary Member

Selected for Awards and Honors.

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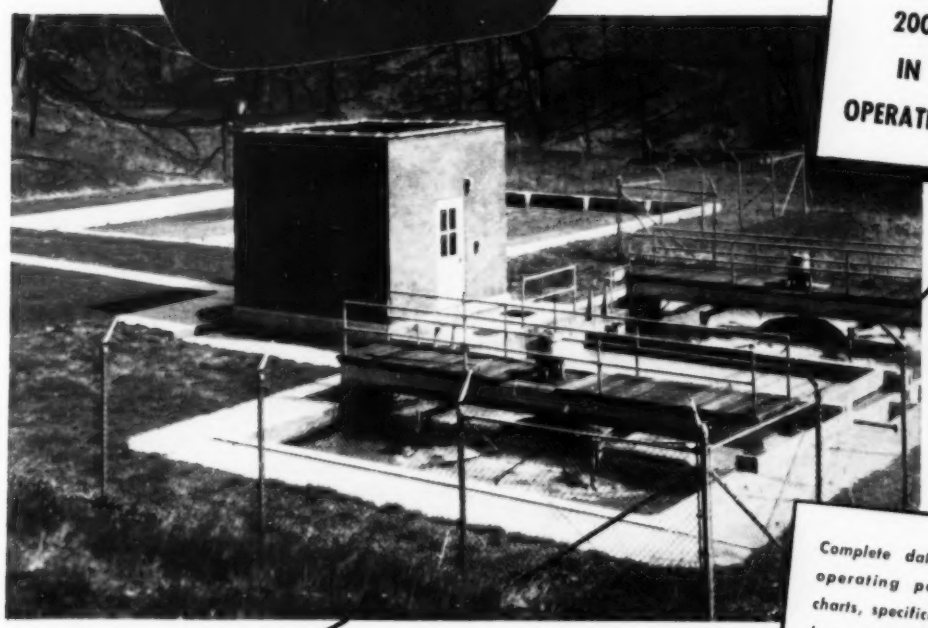

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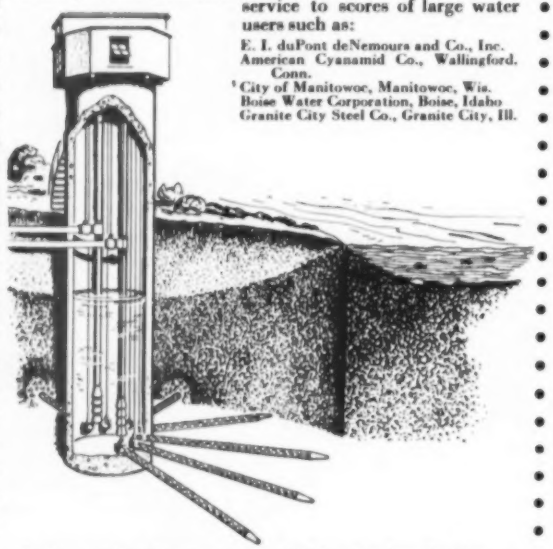
City of Manitowoc, Manitowoc, Wis.
Boise Water Corporation, Boise, Idaho
Granite City Steel Co., Granite City, Ill.



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Meetings Scheduled

Feb. 10-11—Portland, Me.
MAINE WATER UTILITIES ASSOCIATION. (Annual Meeting), Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Feb. 11-13—Indianapolis, Ind. *(Lincoln Hotel)*
INDIANA SECTION A.W.W.A. Sec'y, Geo. G. Fassnacht, 366 Good Ave., Indianapolis 19, Ind.

Feb. 17—Newark, N.J. *(Essex House)*
NEW JERSEY SECTION A.W.W.A. (Winter Luncheon Meeting). Sec'y, C. B. Tygert, Box 178, Newark, N.J.

Feb. 19—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASS'N. Sec'y, Jos. C. Knox, 73 Tremont St., Boston, Mass.

Feb. 19-20—Columbus, Ohio *(Ohio State Univ. Campus)*
OHIO WATER CLINIC. Director, Assoc. Prof. Kenneth W. Cosens, Ohio State University, Columbus, Ohio.

Feb. 26-28—Dallas, Texas *(Baker Hotel)*
AMERICAN CONCRETE PIPE ASSOCIATION. (45th Annual Convention). Director, Howard F. Peckworth, 228 N. LaSalle St., Chicago, Ill.

Mar. 8-12—College Station, Texas *(Texas A. & M. College)*
TEXAS WATER WORKS & SEWERAGE ASSOCIATION. (Annual Meeting.) Sec'y, V. M. Ehlers, State Dept. of Health, Austin, Texas.

Mar. 11-13—Atlantic City, N.J. *(Traymore Hotel)*
NEW JERSEY SEWAGE & IND. WASTES ASSOCIATION. Sec'y, M. S. Kachorsky, Box 766, Manville, N.J.

Mar. 16-18—Little Rock, Ark. *(Hotel Marion)*
ARKANSAS WATER & SEWAGE CONFERENCE. Sec'y, Dr. Harrison Hale, Southern State College, Magnolia, Ark.

Mar. 18-19—Baton Rouge, La. *(Louisiana State Univ.)*
SHORT COURSE FOR WATER & SEWERAGE DEPT. PERSONNEL. (Examinations for Certificates Mar. 20.) Director, John H. O'Neill, Dept. of Health, Civil Courts Bldg., New Orleans, La.

Mar. 18-20—Chicago, Ill. *(LaSalle Hotel)*
ILLINOIS SECTION A.W.W.A. Sec'y, J. Leslie Hart, 122 S. Michigan Avenue, Chicago, Ill.

Mar. 19—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND SECTION A.W.W.A. Sec'y, G. G. Bogren, 14 Beacon Street, Boston, Mass.

Mar. 19—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASS'N. Sec'y, Jos. C. Knox, 73 Tremont St., Boston, Mass.

Mar. 19-20—Chapel Hill, N.C. *(Univ. of No. Carolina)*
SECOND SOUTHERN MUNICIPAL & IND. WASTE CONFERENCE. (Sponsored by Duke Univ., Univ. of N.C. & N.C. State College.) Arrangements Chmn., Dr. Daniel A. Okun, Assoc. Prof. of San. Eng., Univ. of North Carolina, Chapel Hill, N.C.

Mar. 23-25—Macon, Ga. *(Hotel Dempsey)*
SOUTHEASTERN SECTION A.W.W.A. Sec'y, T. A. Kolb, Wade Hampton Bldg., Columbia, Ga.

Apr. 2-4—Spartanburg, S.C. *(Clemson College)*
SOUTH CAROLINA WATER & SEWAGE WORKS ASSOCIATION. Sec'y, W. T. Linton, Wade Hampton Bldg., Columbia, S.C.

Apr. 6-8—Buffalo, N.Y. *(Hotel Statler)*
CANADIAN SECTION A.W.W.A. Sec'y, Dr. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto, Ont.

Apr. 15—Livermore Falls, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Apr. 16-17—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, Dept. Civil Eng., Univ. of Nebraska, Lincoln, Neb.

Apr. 16-17—Elmira, N.Y. *(Mark Twain Hotel)*
NEW YORK SECTION A.W.W.A. (Spring Meeting). Sec'y, Rollo K. Blanchard, 50 West 50th Street, N. Y. 20, N.Y.

Apr. 16-18—Chandler, Ariz. *(Hotel San Marcos)*
ARIZONA SECTION A.W.W.A. Sec'y, M. V. Ellis, 46 W. Encanto Blvd., Phoenix, Ariz.

Apr. 16-18—Chandler, Ariz. *(San Marco Hotel)*
ARIZONA SEWAGE & WATER WORKS ASSOCIATION. Sec'y, M. V. Ellis, Sewage Treatment Plant, Phoenix, Ariz.

Apr. 16-18—Portland, Ore. *(Multnomah Hotel)*
PACIFIC NORTHWEST SECTION A.W.W.A. Sec'y, O. P. Newman, Boise Water Corp., Boise, Idaho.

Apr. 22-24—Wichita, Kans. *(Hotel Broadview)*
KANSAS SECTION A.W.W.A. Sec'y, Harry W. Badley, 119 W. Cloud, Salina, Kans.

Apr. 22-24—Wichita, Kans. *(Hotel Broadview)*
KANSAS SEWAGE & IND. WASTES ASSOCIATION. Sec'y, D. F. Metzler, Marvin Hall, Univ. of Kansas, Lawrence, Kans.

Apr. 22-25—Santa Barbara, Calif. *(Mar Monte Hotel)*
CALIFORNIA SEWAGE & IND. WASTES ASSOCIATION. Sec'y, Sam A. Weed, Room 315, City Hall, Oakland 18, Calif.

Apr. 23—Kalispell, Mont. *(Kalispell Hotel)*
MONTANA SEWAGE WORKS ASSOCIATION. Sec'y, Harvey W. Taylor, State Board of Health, Helena, Mont.

Apr. 24-25—Kalispell, Mont. *(Kalispell Hotel)*
MONTANA SECTION A.W.W.A. Sec'y, A. W. Clarkson, State Board of Health, Helena, Mont.

May 4-6—Lafayette, Ind. *(Purdue Memorial Union Bldg.)*
EIGHTH PURDUE INDUSTRIAL WASTE CONFERENCE. Chairman, Prof. Don E. Bloodgood, Purdue Univ., Lafayette, Ind.

May 10-15—Grand Rapids, Mich. *(Exhibits and Technical Sessions—Auditorium. Hotels—Various*)*
AMERICAN WATER WORKS ASSOCIATION (73rd Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Ave., New York 17, N.Y.
*(*For reservations apply A.W.W.A. Office)*

June 3-5—Peoria, Ill. *(Hotel Pere Marquette)*
CENTRAL STATES SEWAGE & IND. WASTES ASSN. Sec'y, A. P. Troemper, Ill. Water Board, Springfield, Ill.

June 10—Bath, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

June 17—Martinsville, N.J. *(Martinsville Inn)*
NEW JERSEY SECTION A.W.W.A. (Summer Outing & Inspection of Johns-Manville Research Center, Finderne, N.J.—Luncheon at Inn). Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

June 17-19—Hershey, Pa. *(Hotel Hershey)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, Dept. of Health, Greensburg, Pa.

June 17-19—Akron, O. *(Mayflower Hotel)*
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONFERENCE. Sec'y, Ward E. Conrad, 301 Ohio Dept. Bldg., Columbus, O.

June 18—York Harbor, Me. *(Marshall House)*
NEW ENGLAND WATER WORKS ASSOCIATION (June Conference). Sec'y, Jos. C. Knox, 73 Tremont St., Boston, Mass.

June 29-July 3—Atlantic City, N.J. *(Hotels Chalfonte and Haddon Hall)*
AMERICAN SOCIETY FOR TESTING MATERIALS. Sec'y, R. E. Hess, 1916 Race St., Philadelphia, Pa.

Aug. 12—Sanford, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Aug. 24-26—State College, Pa.
PENNSYLVANIA WATER WORKS OPERATORS ASSN. Sec'y, R. R. Kountz, Penna. State College, State College, Pa.

Aug. 26-28—State College, Pa.
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 1-5—Winnipeg, Can. *(Royal Alexandria)*
MINNESOTA SECTION A.W.W.A. Sec'y, L. N. Thompson, Water Department, St. Paul 2, Minn.

Sept. 10-11—Lake Placid, N.Y. *(Lake Placid Club)*
NEW YORK SECTION A.W.W.A. Sec'y, R. K. Blanchard, 50 West 50 St., New York, N.Y.

Sept. 10-11—Cleveland, O. *(Hotel Cleveland)*
OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, Ohio.

(Continued on page 98A)

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Meetings Scheduled

(*Continued from page 97A*)

Sept. 21-23—Owensboro, Ky. *(Hotel Queensboro)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, J. W. Finney, 420 6th Ave. N., Nashville, Tenn.

Sept. 22-24—Milwaukee, Wis. *(Hotel Pfister)*
WISCONSIN SECTION A.W.W.A. Sec'y, L. A. Smith, City Hall, Madison 3, Wis.

Sept. 28-30—Poland Spring, Me. *(Poland Spr. House)*
NEW ENGLAND WATER WORKS ASSOCIATION (72nd Annual Convention). Sec'y, Jos. C. Knox, 73 Tremont St., Boston, Mass.

Oct. 4-6—Jackson, Miss. *(Hotel Heidelberg)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Chas. W. White, State Dept. Health, 537 Dexter Ave., Montgomery, Ala.

Oct. 13-16—Miami, Fla. *(Municipal Auditorium)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSN. (26th Annual Meeting). Exec.-Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.
(joint Meeting with)
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, D. P. Schiesswohl, P.O. Box 210, Jacksonville, Fla.

Oct. 14—Rumsford, Me.
MAINE WATER UTILITIES ASSOCIATION (Annual Meeting). Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Oct. 14-16—Waterloo, Iowa *(Hotel Russell Lamson)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

Oct. 18-21—Houston, Tex. *(Rice Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, L. A. Jackson, Robinson Auditorium, Little Rock, Ark.

Oct. 19-24—New York, N.Y.
AMERICAN SOCIETY OF CIVIL ENGINEERS (Annual Meeting). Sec'y, Wm. N. Carey, 33 W. 29 Street, New York 18, N.Y.

Oct. 20-23—Atlantic City, N.J. *(Chalfonte Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 22-24—Atlantic City, N.J. *(Madison Hotel)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

Oct. 27-30—San Francisco, Calif. *(Palace Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, J. C. Luthin, 1113 Laurent St., Santa Cruz, Calif.

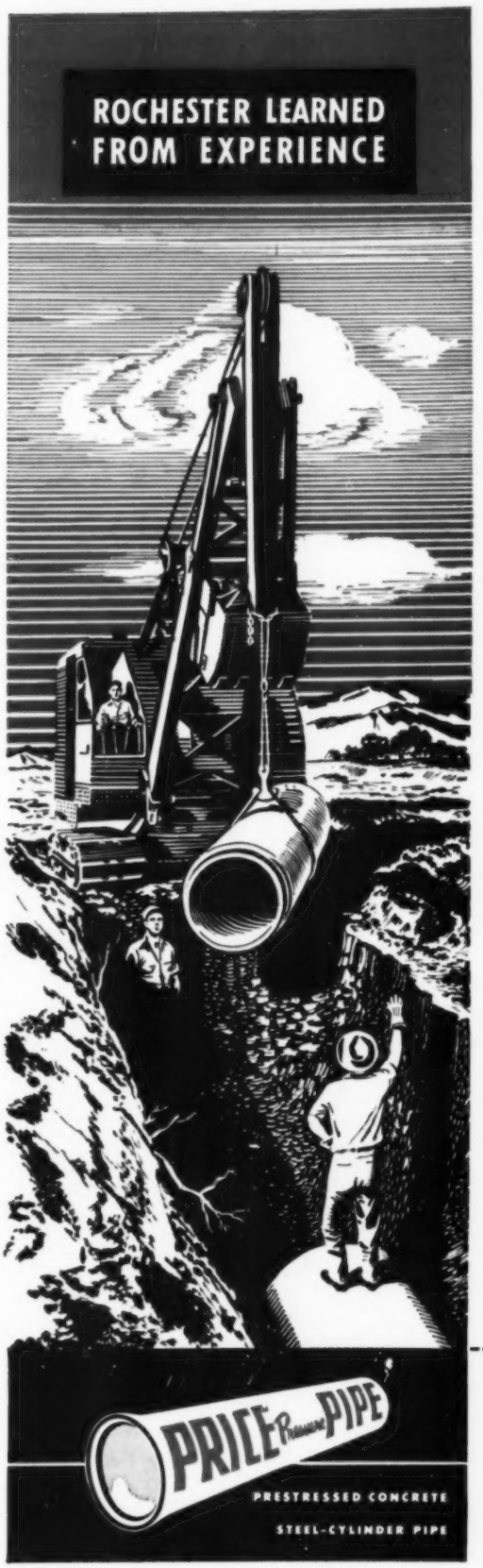
Oct. 28-30—Wilmington, Del. *(Hotel DuPont)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, C. J. Lauter, 6955 33rd Street, Washington 15, D.C.

Nov. 4-6—Roanoke, Va. *(Hotel Roanoke)*
VIRGINIA SECTION A.W.W.A. Sec'y, W. H. Shewbridge, 708 State Office Bldg., Richmond 19, Va.

Nov. 12-13—Lincoln, Neb. *(Hotel Capitol)*
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Paul W. Mousel, 602 W. B. Street, McCook, Neb.

Nov. 8-13—New York, N.Y.
AMERICAN PUBLIC HEALTH ASSOCIATION. Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Dec. 9—Waterville, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.



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Please send me, without obligation, the following literature:

☐ Rochester's new water supply line

☐ Complete facts on Prestressed Pipe

Name_____

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City_____ State_____

Water Pollution Research in British Report

The annual report on the work of the water pollution research laboratory of the Dept. of Scientific and Industrial Research, London, England, entitled "Water Pollution Research 1951" was released late in 1952. The publication includes the report of the Water Pollution Research Board and that of the Director of the Laboratory on work carried out during the year.

Included in the report are the results of experiments, one at Coventry and one at Birmingham, on treatment of sewage by alternating double filtration; the results of the continuing experiments at Stivichall in collaboration with the Gas Research Board on the addition of spent gas liquor to sewage and the effect on processes used for the treatment of sewage of five commonly used radio-isotopes. The work on radio-isotopes is to be continued and a special laboratory has been built for the purpose.

The report also contains experimental work on acceleration of dewatering of sewage sludge by electro-osmosis; particulars are given of the composition of waste waters from the manufacture of penicillin and methods for treating these liquors are described. An account is given of further work on conditions affecting the toxicity of potassium cyanide to trout. This work is being carried out in the development of a standard test for toxicity of sewage and industrial wastes.

For copies of the report write to His Majesty's Stationery Office, London, England. The price is $.65 per copy.

...MEN AT WORK!

Beneath the surface of this undisturbed street in Washington, D. C. men are at work . . . reconditioning water pipelines with the Centriline process. Above ground, traffic flows smoothly . . . unobstructed by the usual men, machinery and excavations.

Because the Centriline process centrifugally applies cement-mortar lining to pipes in place, excavation time, overall costs and interruption to street traffic are kept at an absolute minimum. Couple these advantages with the fact that Centrilining permanently prevents corrosion and tuberculation, increases carrying capacity, reduces pumping costs, gives new pipe service at a fraction of the cost of new pipes, and you have the reason why more and more city engineers and officials are specifying Centriline for their pipeline projects.

CEMENT-MORTAR LININGS FOR PIPES IN POSITION

2,298,688 FEET OF EXPERIENCE

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ON THE WEST COAST, WRITE PIPE LININGS, INC., P. O. BOX 3428, TERMINAL ANNEX, LOS ANGELES, CALIFORNIA

Water Purification Unit Developed by Army Meets Severe Tests

The Army's new truck-mounted water purification unit, which is capable of clarifying, filtering, purifying and distributing 2,400 gal. of water an hour in temperatures as low as 40 degrees below zero, was recently demonstrated before defense and city officials at Richmond, Va.

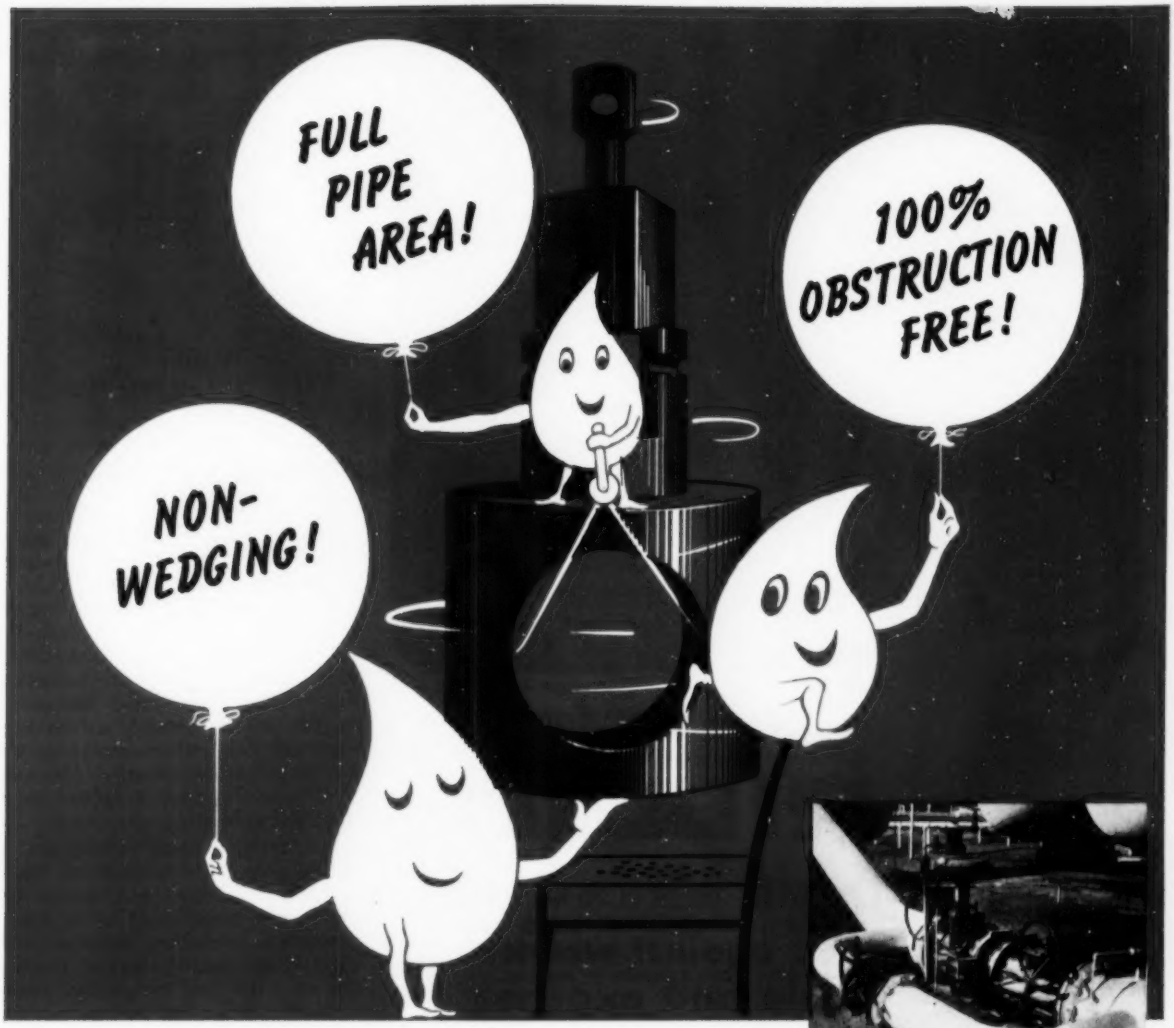
The unit, which can easily be transported on a cargo-type plane to combat zones, contains several inventions and numerous developments resulting from years of basic and applied research at the Engineer Research and Development Laboratories, Fort Belvoir, Va.

Heart of the unit is an ultra-high rate solids contact water conditioner called an erdlator. This device is connected in series with diatomite filters, and the combination not only removes silt and destroys bacteria, but also provides positive physical barriers to the passage of organisms which cause dysentery and schistomiasis, a serious water borne disease found in the Far East.

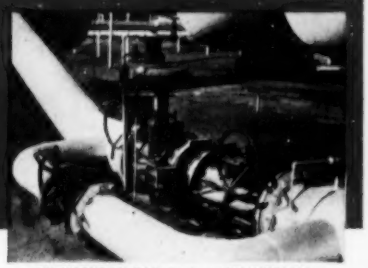
Polluted water can be pumped into the unit, chemically and physically treated, and discharged as potable water in approximately 20 minutes. Its excellent performance and short detention time is attributed to the use of a material which is almost universally available and costs less than $12.00 a ton.

Only one man is required to operate the unit and it can be put into operation by three men in less than 90 minutes after arrival at a selected site. Equipped with its own power source, it can be operated in total blackout. The only noise audible is

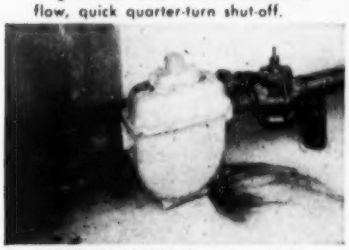
(*Continued on page* 102A)



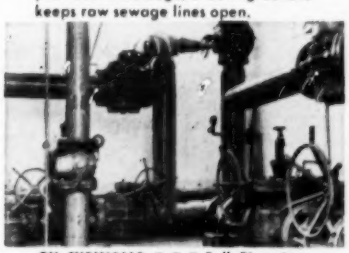
This a.c.f. Full Round Port CYLINDRICAL PLUG VALVE—with all its sound, true economy features—is made especially for critical installations where uninterrupted, fast flow is a necessity. a.c.f. Round Port Valves are available in sizes up to 12 inches. a.c.f. Rectangular Port Valves also offer full pipe area. *And here's a new, added feature!* a.c.f. Valves are now available with TEFLON head gaskets, for easier turning, greater protection against leakage on difficult services. When next you specify, why accept less—ask for a.c.f.



ON NATURAL GAS a.c.f. **CYLINDRICAL** Plug Valves have no obstruction to flow, quick quarter-turn shut-off.



IN SEWAGE PLANTS the a.c.f. Valve provides knife-edge, shearing action, keeps raw sewage lines open.



ON CHEMICALS a.c.f. Full Pipe Area stops abrasion from suspensions, no contamination of ladings.

a.c.f. CYLINDRICAL FULL PIPE AREA PLUG VALVES

Write for Catalogue 4-WS, American Car and Foundry Co., Valve Division, 1501 E. Ferry Ave., Detroit 11, Mich.

Representatives in 50 Principal Cities

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

If this Housing ever Breaks or Distorts we will replace it Free
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HEAVY DUTY
"RIDGID" means most service for your money!

Only Genuine

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PIPE WRENCHES

Guarantee you against wrench housing trouble and expense

Look for the wrench with that guarantee label to make sure you get the extra-easy work and extra durability that have made RIDGID the world's most popular wrench.

Only RIDGID assures you a hookjaw that always rides freely in the housing; adjusting nut always spins easily to pipe size. Replaceable alloy jaws won't slip or lock on pipe. Handy pipe scale on hookjaw. Safe stout comfort-grip I-beam handle.

Save work and money—buy genuine RIDGIDs at your Supply House.

THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U.S.A.

RIDGID

Work-Saver Pipe Tools

(*Continued from page* 100A)

from the engine driving the generator.

The Virginia State Department of Health cooperated with the Engineer Research and Development Laboratories in conducting engineering tests. The recent demonstration was the last lap of a five-site test program suggested by Mr. Richard Messer, Director of the Division of Engineering, Virginia State Department of Health. The unit was also tested at Emporia, Portsmouth, Newport News, and Williamsburg. Water in each of the sites presents unique purification problems.

Fluoridation Installations Grow in Number

Fluoridation of community water supplies as a dental health measure has spread rapidly during 1952. In January of this year, according to the Washington Health Council, 160 communities in the United States were using the fluoridation process. By December this number had grown to 453, while some 400 others have approved fluoridation measures and are installing equipment. The supporters of fluoridation appear to be making headway.

A development in the state of Washington is of interest. A Superior Court judge in Chehalis has ruled that fluoridation as a health measure is as much a municipal prerogative and function as the chlorination of water, and invades no constitutional rights. The ruling has been appealed to the state Supreme Court, where the decision handed down may have widespread effect. The case is termed the first in which the legal propriety of fluoridation has been tested in court.

Sanitary Conditions in U. S. Still Need Improvement

Some sanitary conditions in the United States are worse than they were 50 to 100 years ago, says Dr. Harold B. Gotaas, professor of sanitary engineering, Univ. of California. He reported that there are still some 6,000 American communities without a public water supply and over 9,000 without a sewage system.

"And there is scarcely a city in the United States today in which atmospheric pollution conditions are not worse than they were a century ago," said Dr. Gotaas. Increased sanitary problems are the result of urban and suburban growth, industrialization, increased travel and changing living conditions, he said.

Rhine Pollution Spoils Haunts of the Lorelei

Though the Bonn government's ministers are less addicted to Wagnerian operas than was Adolf Hitler, they are considerably worried over the Lorelei.

It appears that the lovely siren, whose song beguiled Rhine fishermen and whose smile sped them to their doom on the downstream shoals where she lurked, today would be quite unable to use her wiles. Not only has the famous river lost its crystalline flow to become an opaque, stinking stream whose smell the fatal maiden never could stand, but she would not encounter any boatmen to lure, since water pollution has killed most of the fish, shooing away both fishermen and tourists.

The cause of all the woe lies in the canals, which spill into the Rhine river, bringing in dangerous impurities.

German specialists are devising stringent measures to prevent that pollution, and preserve in the lower Rhine the same pure water which tumbles and foams at the Schaffhausen falls in the Swiss Alps. They figure that even if the Lorelei fails to return, at least romance loving tourists, eager to see the legendary haunts of the enchantress, may show up again, bringing with them a golden flow of dollars and other precious currencies. The salmon, too, would come back and contribute a welcome addition to the still meager German bill of fare.

New Virginia Bulletins on Water Resources

Two new bulletins in the series published by the Division of Water Resources of the Virginia Dept. of Conservation and Development have recently been issued.

Bulletin No. 11 is entitled, Chemical Quality of Surface Waters of Virginia—1946-1948." This bulletin contains information for waters of the James River Basin and of the Nottoway, Blackwater and Meherrin Rivers in Southeastern Virginia.

Bulletin No. 12, entitled "Surface Water Supply of Virginia," is a compilation of all stream flow records for the Potomac, Rappahannock and York River Basins in the northern part of Virginia for the period October 1, 1942 to September 30, 1950.

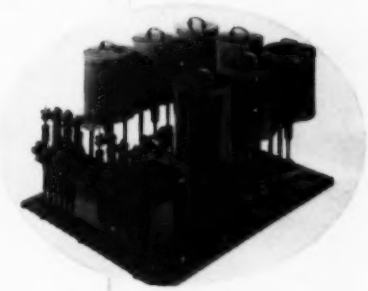
Bulletins No. 11 and 12 are available upon request to the Division of Water Resources, Virginia Department of Conservation and Development, P. O. Box 1338, University Station, Charlottesville, Va.

UTMOST PROTECTION

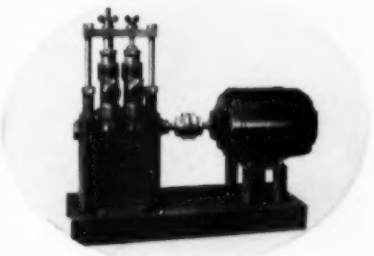
at lowest cost

Manzel CHEMICAL FEEDERS and HYPOCHLORINATORS

To the cost-conscious water and sewage treatment plant Manzel Feeders pay dividends in accuracy, dependability, and *surprising* economy of purchase and maintenance. Built by an organization famous for fifty years in the manufacture of automatic force feeding equipment, Manzel design is *thoroughly* proven. Whatever your feeding problem, ask Manzel.

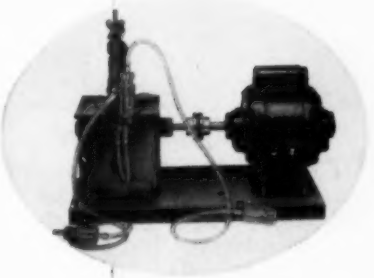


MULTI-FEED CHEMICAL FEEDERS
Any number of pumping units can feed the same or different chemicals simultaneously.



LARGE OR SMALL CAPACITIES
Various models pump from a fraction of a drop to 60 gph. All types of drives are available.

MANZEL HYPOCHLORINATORS
Positive, precise, and *low cost.* Easy to install and service.



Look at these Quality Features

- **Full control**... *accurate adjustment from 0 to full feed.*
- **Wide range** *of feed covers nearly every job.*
- **Positive in action**... *no clogging.*
- **Sight Feed** *and solution strainer.*
- **Easily adjusted** *while running.*

Manzel

243 Babcock Street, Buffalo 15, N. Y.

ACTION *proves* **MARLOW PUMPS** *are the* **BEST** *. . . for dependable, low-cost performance!*

Again Marlow gets the job!*

*23 Marlow Plunger Sludge Pumps Installed at the Southeast Sewage Treatment Plant, San Francisco, Calif. —for re-circulation, draw-off and transfer of sludge.

ONCE MORE—Marlow Pumps are relied on for dependable, low-cost performance. Already over 400 municipalities, across the country, have installed Marlows because they are efficient, reliable and durable. They are built for the hard jobs and give that extra "plus" when constant pump performance counts most.

At the Southeast Sewage Treatment Plant, Marlows do a complete job:

- **re-circulating sludge in digesters and transfer of sludge between digesters**
- **draw-off of sludge from digesters at a steady rate**
- **transfer of processed sludge from one elutriation tank to another**
- **transfer from final elutriation tank to vacuum filters**
- **transfer of raw sludge from thickening tanks to holding tanks or digesters.**
- **re-circulation of raw sludge in holding tanks or between holding tanks and receiving and thickening tanks.**

Marlow Plunger Sludge Pumps are the direct result of many years of "on-the-job" research and development. They have set the pace for design refinements to meet job specifications.

- Remember . . for pumping sludges or heavy industrial wastes Marlows do the job better because they are designed and built better. Marlow *means* good pumping.

Available in simplex, duplex, triplex or quadruplex assembly. 360 to 30,000 GPH capacity.

Write for details today. 105

MARLOW PUMPS RIDGEWOOD, NEW JERSEY

Branch Plant De Queen, Arkansas

Other factories in France and England. Distributors and Dealers everywhere.

Pickups from "Sanitary Engineering News"

Don E. Bloodgood, Editor

Sperry at Aurora, Ill., has found that Venturi meter readings may be as much as 20% in error (high, that is), due to the deposition of material in the throat of the Venturi meter.

* * *

There is ample evidence to show that the characteristics of domestic sewage depend to a great extent upon the diet of the population.

* * *

Engineers are "one woman men" on the whole. Questionnaires from 9000 engineers show that 87% are married, 96% are still married to their first wife.

* * *

A new book published by Chemnomics, Inc., 400 Medicine Ave., New York, is titled "Industrial Water Pollution." It is reported to cover the essential aspects of the laws and regulations of the several states and territories.

* * *

The ASCE has put out a pamphlet on utilization of underground storage reservoirs for water. Sometime in the future people will probably wonder why we took up good area with surface reservoirs which allow the water to become warm and grow algae.

* * *

One way to succeed is to keep your head up and your overhead down.

* * *

Michigan State College Engineering Experiment Station reports a new waste treatment process in which fine bubbles carry to the surface practically all of the suspended material.

* * *

For years, Ohio State University has refused to pay sewer rental fees to the city on the grounds that it was not liable for such payments because of technical reasons. The court reviewed the city's appeal for payment and, in 1949, ruled that the University must pay back rental charges. Thereupon, the city received a check for $125,000 from the College.

* * *

Clogged Zeolite Softeners have been cleared with Sterimine.

* * *

It is interesting to note that in California there are about 42 cities and towns which use treated sewage effluents for the irrigation of crops.

* * *

The expansion of the Fort Worth sewage plant calls for 2.25 hours aeration followed by settling before discharge on to trickling filters. Specifications for the filter stone are:

Wear-L.A. Abrasion Test, ASTM, C-131. Not more than 30.

Sodium Sulphate Test, 20 cycles, ASCE Manual 13—Loss not over 10%.

Apparent Specific Gravity, ASTM C131—47. Not less than 2.60.

Absorption, ASTM, C127-47—Not more than 1%.

Organic matter—None.

* * *

Placed end to end, the molecules in a pint of water would encircle the Earth 200,000,000 times. Figure it out.

* * *

"The Water Situation in the United States with Special Reference to Ground Water," the first comprehensive compilation of ground water data on a nation-wide scale is available from the U.S. Geological Survey in Washington, D. C.

* * *

Detergents in sewage treatment continue to cause sufficient difficulty to be discussed by C. E. Keefer. Did you see the pictures of the "suds busters" recently shown in a national magazine. What could this magazine be? Some mess!

* * *

In a recent report from England it was stated that the commonest single factor responsible for unsatisfactory sewage effluents, particularly in smaller works, was inadequate sludge drying area. The tendency has been to design on the basis of five persons per sq. yd. or even more. Rochdale, with a wet climate, designed for three persons per sq. yd. for digested sludge, is reported to have barely enough.

* * *

The city of Beloit in Wisconsin has had to purchase land in the State of Illinois on which to build a new sewage treatment plant. Can the Federal authorities regulate interstate transportation of sewage.

* * *

The Fisher Governor Company of Marshalltown, Iowa saves $8,000 yearly by recovery and purification of waste cutting oils.

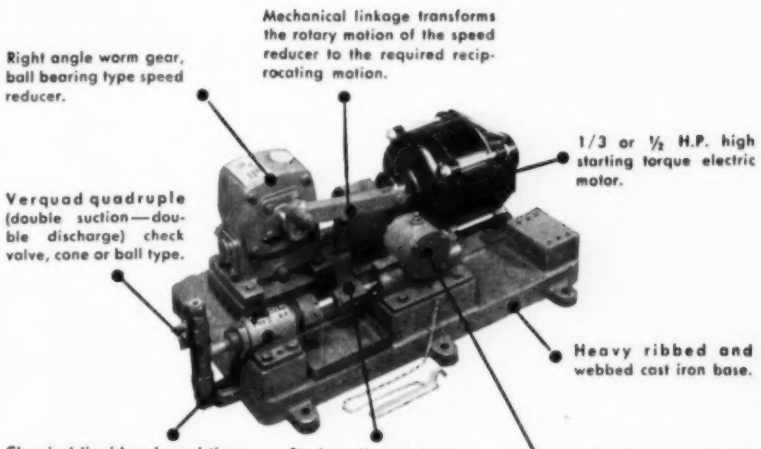
* * *

The rust tubercle is almost as much a mystery today as it was thirty years ago when it was first explored.

* * *

The production of alcohol from sugar can be speeded up by a new vitamin-like material extracted from dried activated sludge.

Simplicity of design plus precision manufacture


Right angle worm gear, ball bearing type speed reducer.
Mechanical linkage transforms the rotary motion of the speed reducer to the required reciprocating motion.
1/3 or ½ H.P. high starting torque electric motor.
Verquad quadruple (double suction—double discharge) check valve, cone or ball type.
Heavy ribbed and webbed cast iron base.
Chemical liquid end consisting of interchangeable barrel and housing assembly containing the plunger, packing and packing gland.
Stroke adjustment coupling. Stroke adjustment WHILE PUMP IS IN OPERATION is optional.
Sealed-in-oil precision rack and pinion assembly drives the plunger in the liquid end.

assure high standards of accuracy and dependability in Hills-McCanna "U" type metering and proportioning pumps

Whenever small volume flows must be metered or proportioned continuously, the simple, foolproof design of Hills-McCanna "U" Type Pumps pays big dividends. For flows up to 24 gallons per hour per feed, its accuracy and reliability suit it for research, pilot plant operation and full scale processing alike.

The "U" type pump is available in a range of capacities with 1, 2, 3 or 4 feeds. Its design permits use of a wide variety of materials of construction in the liquid end.

Write for descriptive literature which gives full information. HILLS-McCANNA CO., 2357 W. Nelson Street, Chicago 18, Ill.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of:
SAUNDERS TYPE DIAPHRAGM VALVES
FORCE FEED LUBRICATORS • MAGNESIUM SAND ALLOY CASTINGS

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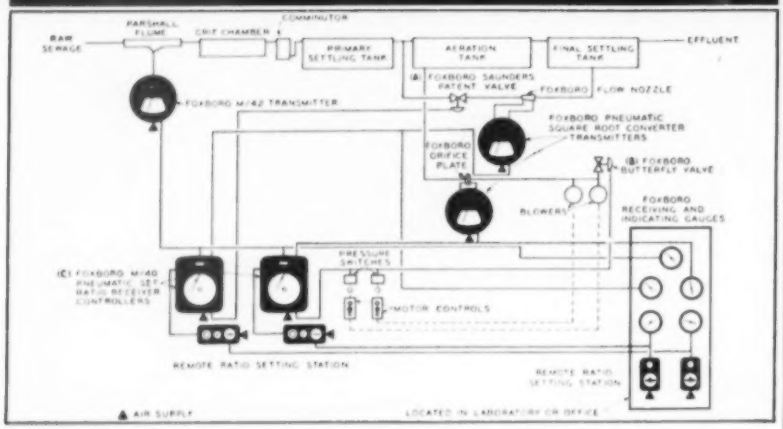
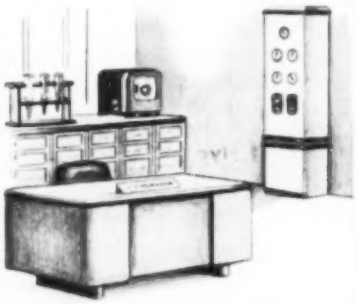
How to reduce "Bulking" in your activated sludge process



Schematic diagram shows typical installation. Rate of return sludge is controlled by (A) Foxboro Pneumatically Operated Valve located downstream from a Foxboro Flow Nozzle. Air flow rate is controlled by (B) Foxboro Butterfly Valve on blower relief line with an orifice plate in discharge line. Both control valves are actuated by (C) Foxboro M/40 Receiver Controllers and provide a fixed ratio of influent to air and return sludge in the aeration tank.

THIS FOXBORO system of aeration and return sludge control *automatically* maintains desired ratios of influent to air and to return sludge. You just set the selector switches at the proper ratios and Foxboro Controllers take over . . . no manual operation of valves . . . no need for 24-hour operational watches . . . less danger of "bulking" in final settling tank, regardless of variations in influent rate. Moreover, the Foxboro M/40 Ratio Receiver Controllers give you a permanent, continuous operational record for your files.

Why not learn more about this modern Foxboro Control System . . . write for Application Engineering Data Sheet 833-9. **The Foxboro Company, 892 Neponset Avenue, Foxboro, Mass., U.S.A.**



Remote setting stations can be located in laboratories or office so that Chemists or Superintendent may change the ratio setting without going to the main instrument cabinet.

FOXBORO
Reg. U.S. Pat. Off.
ACTIVATED SLUDGE CONTROL

Inertol Grease Coating for Metal Protection

201

Inertol Co., Inc., Newark, N.J., has developed a new product that makes it possible to coat submerged machinery and put the unit back into service in a couple of hours, total time.

Speedy Inertol Grease Coating requires no surface preparation. It is applied right on over rust and old paint. Saving hours of chipping, wire-brushing and hammering.

Inertol Grease Coating can be applied to a damp surface. Work can start as soon as the tank is dewatered. No waiting around for the parts to dry. Only one coat is needed, and it goes on swiftly by brush, swab, spray, or by hand with cotton gloves.

With a minimum of out-of-service time Inertol Grease Coating gives thick protection to machinery, chains, rails, conveyors, shafts, distributor arms, gates and a hundred other steel parts difficult to coat. Chemical rust inhibitors in the coating prevent rust from forming on bright metal. Stop present rust from spreading. Loosen existing rust for easy removal. And Grease Coating starts work immediately on application of the one quick coat. Requiring only one coat, it saves on material cost.

New Appointments at Johns-Manville

Johns-Manville Corporation, New York, N.Y., has announced the appointments of Don L. Hinmon, as Assistant to the General Manager of the Industrial Products Division; and A. J. Bette as Product Manager for Friction Materials; E. H. Wells, as Assistant to the Merchandise Manager; and G. R. R. Wahl, as Assistant Product Manager for Transite Pipe.

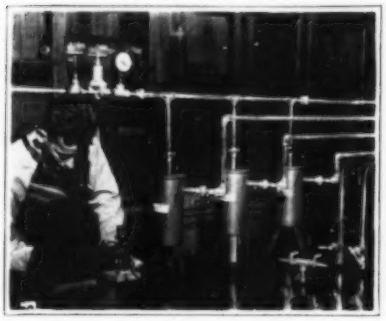
A graduate of Iowa State College, Mr. Hinmon joined J-M in 1936. In 1948 he was named Manager of the Aviation Section of the Special In-

dustries Department. He has been Assistant Manager of Transite Pipe since 1951.

Mr. Wells joined J-M in 1928. He has held various positions in the Transportation Department including that of Chief Engineer. In 1948 he was named Product Manager in the Friction Materials Department. He is a graduate of Massachusetts Institute of Technology.

Mr. Bette joined J-M in 1930 and has served as a salesman and District Engineer in the New York District. He has also been Assistant Staff Manager, Packings Department; and more recently Staff Manager of Industrial Relations. He holds a B.S. degree in civil engineering from New York University.

Mr. Wahl has been with the Johns-Manville organization since 1933 when he started as a laboratory assistant at research. He served in the Transite Pipe Division and has held the position of Engineer and Manager of Sales Aids and Analysis. He is a graduate of Harvard University.



Transparent Plastic Pipe For Laboratory Use

202

Elmer E. Mills Corp., Chicago, Ill., has developed transparent plastic pipe and fittings of cellulose acetate butyrate in sizes ranging from ½ inch through 4 inches for laboratory and pilot plant use.

Known as Mills III, the new pipe offers many advantages for handling oils, gases, water, slurries and a wide variety of chemicals because it permits observation of processes, and has extremely high resistance to corrosion and other forms of chemical attack.

Sections of the pipe are quickly and easily joined by a solvent cement that produces a leak-proof, homogenous bond. No threading or special tools are required, even when connecting to standard steel pipe and fittings. Cuts easily with ordinary hand saw. Set-ups may be dismantled and all components used over and over again

Everything's under control- WITH SIMPLEX®

Type S Rate of Flow Controller

ACCURATELY CONTROLS RATE OF FLOW OVER LONG RANGES!

Of the most advanced, proven design, Simplex Type S controllers meet all requirements of modern filter plants! Look at these unmatched advantages:

- Compact design, low weight
- Small overall dimensions
- Ball bearing mounted valve shaft
- Hydrostatically balanced, patented guillotine valves
- Horizontal or vertical installation
- Simple direct action design
- Venturi tube type of differential pressure producer
- Quick starting from open position
- Response to slightest differential pressure
- Extreme accuracy of control over long ranges

For bulletin with full information write to the Simplex Valve & Meter Co., Dept. 2, 6743 Upland Street, Philadelphia 42, Pa.

SIMPLEX®

SIMPLEX VALVE & METER CO.

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

STEVENS

TYPE B-FT RECORDER PROVIDES PERMANENT DATA ON SEWAGE FLOW

At this modern sewage treatment plant in Dallas, Oregon, the STEVENS Type B-FT Recorder provides a permanent graphic record of flow in million gallons per day (range 0-6 MGD) and totalizes the volume in gallons. The STEVENS Recorder is mounted over a stilling well connected to a 9" throat width Parshall flume.

record flow accurately . . . automatically

There is good reason why modern municipal sewage and industrial waste measuring installations use the STEVENS Type B Recorder. It may be wall, pedestal or panel mounted, is easily operated and will give a lifetime of accurate, trouble-free service. This Recorder uses a circular chart which makes one revolution per day or per seven days, as specified, while the pen swings in an arc around an external center—the combined movements thereby producing a graph of the rate of flow (or head) against time. Volume is indicated on a counter-type totalizer. Accuracy of the registration is limited only by the accuracy of the rating to which the totalizer is set. Flow or head (or both) may be indicated on a scale clearly visible through a large glass port.

RECORDS FLOW
RECORDS HEAD
TOTALIZES FLOW
Direct Float Operated or Remotely Controlled

To find out more about the STEVENS Type B Recorder, and how it can simplify the task of compiling accurate flow records, write for FREE Bulletin 25.

SEND FOR NEW STEVENS DATA BOOK

Puts interpretive data at your finger tips. 144 pages of technical data . . . information on float wells and recorder installations . . . a wealth of hydraulic tables and conversion tables.

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Foremost in Precision Hydraulic Instruments Since 1907

LEUPOLD & STEVENS INSTRUMENTS, INC.

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—alterations in any set-up can be made in minutes.

Mills III is tough, shatterproof, and requires a minimum of support. Although semi-rigid, it is flexible enough to permit broad radius bends and considerable misalignment. Sizes up to 2 inches have a working pressure of 100 lbs. per square inch at 100° F.

Rockwell Appoints Johnson Atlanta District Sales Manager

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced the appointment of R. A. Johnson as Atlanta District Sales Manager of Rockwell Manufacturing Company.

Mr. Johnson will be responsible for the coordination of all Meter and Valve Division sales in the Atlanta District, which covers Southeastern United States. He will report directly to J. W. Northcutt, the Regional Manager who is responsible for the southeastern territory from Virginia to Louisiana.

A graduate of the University of Pittsburgh, Mr. Johnson joined Rockwell in 1939 and became a Sales Engineer in the Atlanta District, working in North Carolina and Virginia for over five years. In 1951 he was made Assistant Sales Manager of Liquefied Petroleum Gas Products and held that position until his recent appointment. Prior to his affiliation with Rockwell, he was employed in the Sales Department of the Goodyear Tire and Rubber Company and also served as Manager of the Pittsburgh District Office of the United States Maritime Commission.

New Appointments At Atlas Mineral

Atlas Mineral Products Co., Mertztown, Pa., has announced, as part of its expansion program, the following appointments:

Kenneth Snyder appointed to the new post of Western Division Regional Sales Manager.

Edison C. Sickman appointed New York District Sales Manager.

Earl A. Erich appointed Assistant Sales Manager of fabricated plastic products.

Donald Deakin appointed Assistant Sales Manager of Water & Sewer Materials.

Frank Pegg promoted to Sales Engineering at the Mertztown office.

Donald Weidner, Sales Engineer in Northeastern Pennsylvania.

John Pritchett, Sales Engineer in the Chicago territory.

John R. South, Sales Engineer in the Cincinnati territory.

Frank Beauchner, appointed Purchasing Agent.

Jim Fry placed in charge of new product development.

John R. Swift, Technical Service, assigned to floor problems in the food industry.

Martin H. Smith, Technical Service, assigned to corrosion problems in the paper and textile industry.

Robert E. Evans, promoted to Plant Manager, Texas Plant.

Lt. Col. Winthrop P. Hersey Released from Active Duty

Lt. Col. Winthrop P. Hersey, Army Ordnance Corps Reserve, returned to civilian life recently and resumed his duties as Vice President and General Manager of the Hersey Manufacturing Company, Boston, Mass., manufacturers of water meters.

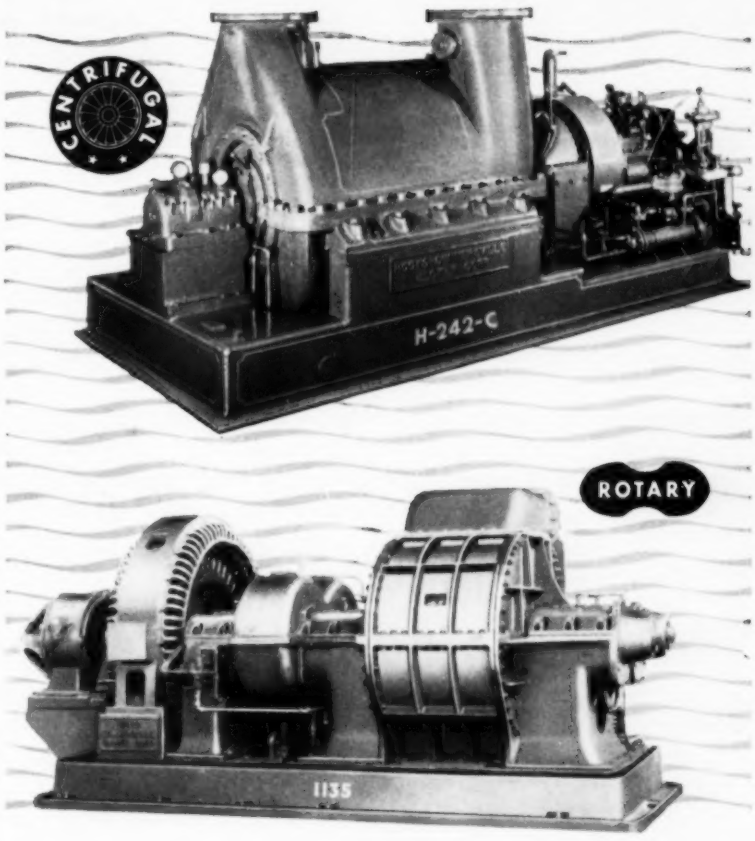
Col. Hersey served for twenty months on recall active duty as Chief of the Contract Administration Division and Assistant Contracting Officer of the Boston Ordnance District. During World War II he served on active duty with the Ordnance Corps for four years.

Improved Sump Pump Design

203

Gorman-Rupp Company, Mansfield, Ohio, announces a new "HI-N-DRY" sump pump designed for easy installation safely outside the sump, on the floor, or on a wall bracket entirely removed from the sump location.

According to the company it is no longer necessary to have a sump pump



BLOWER RELIABILITY A "NATURAL" WITH AIR-MINDED *Specialists*

The long record of reliability established by Roots-Connersville Blowers, Exhausters and related equipment is the natural result of almost a century of experience in the exclusive business of handling gas and air for industrial purposes.

But its more than just designing and building *a* piece of machinery. Such user satisfaction comes also from the wide range of capacities and types, from which the right unit can usually be selected. Especially important, our *dual-ability line* of Centrifugals and Rotary Positives enables us to make unbiased recommendations . . . a *dual choice* available only from Roots-Connersville.

Whatever your need may be in the handling of air or gas for sewage or water treatment plants, you can look to Roots-Connersville for unquestioned reliability and long-time economical performance. Ask us for specific recommendations on any problem of handling gas or air—in any quantity.

ROOTS-CONNERSVILLE
Exclusive Specialists in Handling Gas and Air

ROOTS-CONNERSVILLE BLOWER

A Division of Dresser Industries, Inc.
253 Mount Ave. • Connersville, Indiana

submerged in the sump with the motor exposed to rising fumes and vapors . . . where accumulated sand, silt or abrasives damage the unit or cause pump failure.

Readily accessible for ordinary attention, the new "HI-N-DRY" pump eliminates much maintenance trouble common to old style, vertical type pumps which had to be disconnected and removed from the sump for major repairs. Now, nothing is in the sump but the suction pipe.

Convenient and safe from flash flood conditions, the durable new pump assures long, trouble-free operation. The only parts subject to wear are the bronze impeller and bronze wear plate . . . both quickly and easily replaced with ordinary tools.

Easier to install, dependable, with fewer and simpler maintenance problems, the new Gorman-Rupp "HI-N-DRY" sump pump combines positive self-priming with many other outstanding features.

Armco To Build New Plant

Armco Drainage & Metal Products, Inc., Middletown, Ohio, announced that construction has begun on a new Armco Drainage & Metal Products fabricating plant at Mansfield, Pennsylvania.

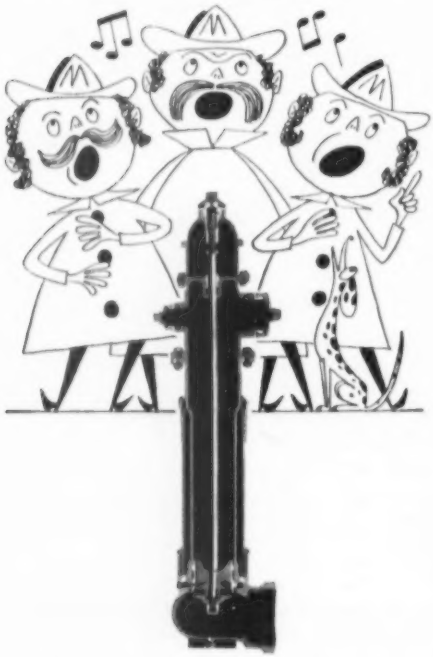
Present plans for the new plant call for fabrication of corrugated metal pipe, both plain and asphalt coated, Armco pipe arch, and fittings for both pipe and pipe arch.

"This new plant at Mansfield, Pennsylvania, will enable Armco Drainage & Metal Products to better serve the active industrial and agricultural area of northern Pennsylvania and eastern New York," Stuart R. Ives, President, stated.

The plant will be built from the ground up with Steelox and other construction materials of Armco manufacture and will have about 25,000 square feet of space under roof.

Operations are scheduled to begin late in the spring.

Installed in Grandfather's Day— Still Providing Full Community Protection



MATHEWS HYDRANTS

Made by R. D. Wood Company

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

• Mathews Hydrants are built to last. They are so simple and well constructed that there's virtually nothing to go wrong.

• Maintenance is easy, too. Operating thread can be lubricated during spring and fall inspections.

• When the time comes to modernize, it is a simple matter to remove the old barrel and replace it with a modern one. The job is done in a few minutes without digging or breaking the pavement.

No Other Hydrant Offers So Many Essential Features

Compression type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle sections easily raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • All working parts contained in removable barrel • A modern barrel makes an old Mathews good as new • Available with mechanical-joint pipe connections

150th anniversary

Sump and Drain Pump

204

Jacuzzi Bros., Inc., Richmond, Calif., has just placed on the market a new submersible type sump pump called a "Sub-Drainer."

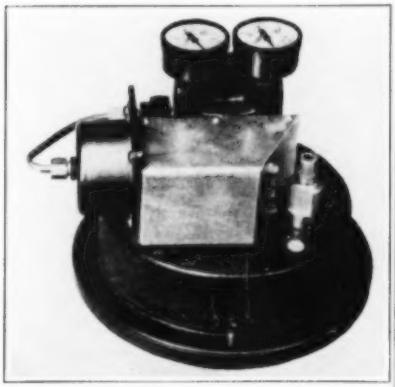
This Sub-Drainer employs a totally enclosed on-off switch sealed inside the water-tight stainless steel motor case, guaranteeing fool-proof automatic service. There are no separate floats or projecting liquid-level controls.

The hermetically sealed ⅓ horsepower motor, complete with 11 foot water-proof cable, and the pump unit operate when submerged partially or under as much as 15 feet of water.

Wentworth Smith Elected Director And Vice President of Neptune Meter

Neptune Meter Company, New York, N.Y., has announced the election of Wentworth Smith as Director and Vice President in Charge of Sales. Mr. Smith fills the vacancy left by the recent retirement of Rex J. Van Gorder after 33 years of service with Neptune.

Mr. Smith joined Neptune in 1949, and spent several years in special marketing studies for the New York firm. He was promoted to General Sales Manager in 1951. Before joining Neptune he was with the sales staff of Safety Car Heating and Lighting Company. Mr. Smith is a graduate of Williams College and attended Yale Graduate School.



Pressure Pneumatic Transmitter

205

Penn Industrial Instrument Corporation has developed a new pressure pneumatic transmitter.

This instrument combines a pressure gauge of highest quality with a reliable pneumatic transmitter. The output pressure of the transmitter varies from 3-15 lbs. (or 5-25 lbs. if specified) regardless of the range of the pressure being measured. Highest accuracy is achieved as the instrument is calibrated with comparison of actual pressure applied to the gauge versus transmitted air.

The gauges used are AA grade gauges in either 6" or 3½" sizes with Bourdon springs available in a very wide variety of materials. Ranges from vacuum to 10,000 PSIG are regularly available. Used with either full size recording receivers or miniature indicating instruments, these units provide greater safety and convenience particularly where high pressures, corrosive, toxic, inflammable or other hazardous fluids are used and permit the use of low pressure air piping to bring pressure indication or recording to any part of the plant. Distances up to 1,000 feet are practical.

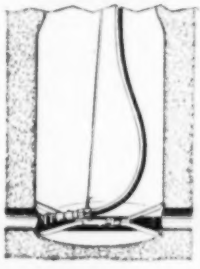
The transmitting instrument is extremely compact and takes no more panel space than the gauge itself. It is suitable for panel, pedestal or wall mounting and is available in either 6" or 8½" size gauges.

Belco Appoints Kipp Manager of Philadelphia Office

Belco Industrial Equipment Division, Inc., Paterson, N.J., has announced the appointment of Hapgood Kipp as District Manager of the company's Philadelphia office, in the Commercial Trust Building.

"FLEXIBLE" *Exclusives* THAT *Revolutionized* SEWER CLEANING

Since 1932 FLEXIBLE has led in pioneering improved sewer cleaning methods and equipment. Here are today's most important "FLEXIBLE" musts!

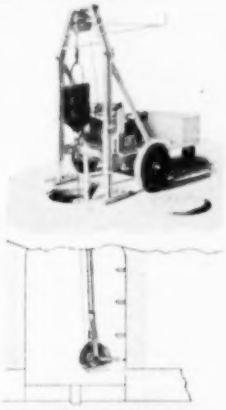


The **SeweRodeR**

A mechanical marvel that does all rodding with one man and a helper. Pushes, turns, pulls . . . pulls back loads and "rods in" for more.

FLEXICROME ROD COUPLING

An improved coupling recommended for HIGH-SPEED POWER TURNING . . . developed through years of experience. Never connects in the wrong hole. Faster to assemble.



***Surface-Hung* MANHOLE ROLLER**

Works loose brick manholes (any size) far faster. Fits any two leg bucket machine. Installs from above ground.

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Francis Hankin — Montreal & Toronto, Canada

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

For the past twelve years Mr. Kipp was Chief Engineer for the American Water Softener Company.

Constant Pressure Differential Regulator and Instrument Air Pressure Regulator

206

Fischer & Porter Company, Hatboro, Pa., has developed a regulator, and a new instrument air pressure regulator. The constant pressure differential regulator is a compact unit consisting of the air pressure regulator and a new phenolic body PURGERATOR Meter piped together on a bracket for wall mounting, or with a bezel which permits front or rear panel mounting. This unit is used to regulate purge flows of liquid or gas, for liquid level measurement or in dual arrangement for specific gravity measurement.

The new instrument air pressure regulator was developed especially for internal case mounting with the P-4 PNEUMATROL pneumatic controller series. It is a compact design with a unique pressure balanced valve which maintains constant discharge pressure with very low "droop."

J. E. Chadwick

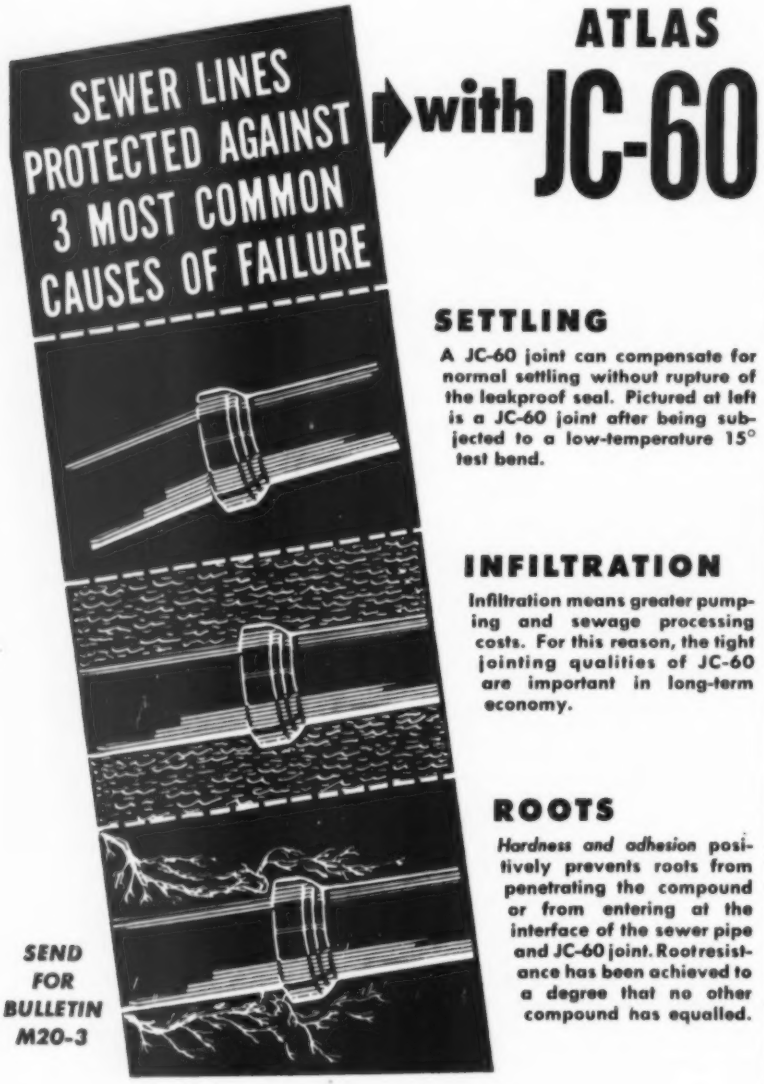
J. S. Conway

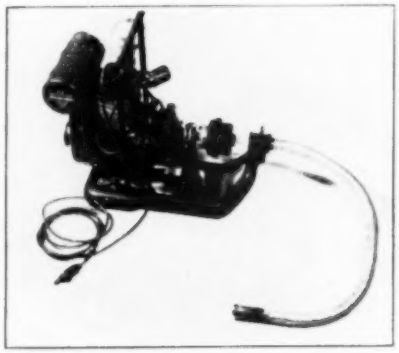
Conway and Chadwick Promoted By Koehring

Koehring Company, Milwaukee, Wisc., has announced two major changes in sales personnel of the Company.

John S. Conway, who was General Sales Manager, has been named Vice-President in charge of Sales and John E. Chadwick, with the company since 1945, was named Sales Manager.

In his new post, Conway will fill the vacancy created earlier this year when Steelman was named President of Koehring. Chadwick will return to the Koehring Company after serving for a year as Western Sales Manager at the Kwix-Mix Company, a Koehring subsidiary located in Port Washington, Wisconsin. Previously he had been Assistant Sales Manager for Koehring.


SEWER LINES PROTECTED AGAINST 3 MOST COMMON CAUSES OF FAILURE
ATLAS
with JC-60
SETTLING
A JC-60 joint can compensate for normal settling without rupture of the leakproof seal. Pictured at left is a JC-60 joint after being subjected to a low-temperature 15° test bend.
INFILTRATION
Infiltration means greater pumping and sewage processing costs. For this reason, the tight jointing qualities of JC-60 are important in long-term economy.
ROOTS
Hardness and adhesion positively prevents roots from penetrating the compound or from entering at the interface of the sewer pipe and JC-60 joint. Root resistance has been achieved to a degree that no other compound has equalled.
SEND FOR BULLETIN M20-3
OTHER ATLAS PIPE JOINTING MATERIALS
For Sewers: GK,® Slipjoint GK,® For Cast Iron Water Pipe: Tegul-MINERALEAD,® Hydrorings
ATLAS JOINTING COMPOUNDS ...a permanent bond
ATLAS MINERAL PRODUCTS COMPANY
MERTZTOWN PENNSYLVANIA
HOUSTON 1, TEXAS



Gasoline Engine Powered Electric Eel

207

Ohio Tool and Engineering Co., Springfield, Ohio, has developed a new gasoline engine powered Electric Eel. It cleans out roots, stones, and debris in one speedy, thorough operation . . . saves time and money . . . eliminates all digging.

Weighing only 66 pounds for easy portability, the Eel is designed to clean pipe 1¼" in diameter and larger—and has sufficient power to handle 300 ft. of cable. The 1½ H.P. gasoline engine is back geared 6 to 1—has an instantaneous kick-out — and an adjustable friction

clutch between the engine and the cables.

This new model also features a flexible connection for joining cables which eliminates breakage at the end of the fittings. The cable itself is available in either regular or heavy duty types. The heavy duty type is actually a double cable—consisting of a rotating inner and a stationary outer cable. It eliminates the possibility of injury to the operator in case of breakage, steps up efficiency, and makes it impossible to lose broken cable in the line.

Washington Representative Appointed By Milton Roy Co.

Milton Roy Company, Philadelphia, Pa., has announced the appointment of the Tower Equipment Company as representatives in the State of Washington. Tower Equipment Company will cover all but the southeastern counties.

The Tower Equipment Company, established two years ago by R. L. Tower, represents several other manufacturers of processing equipment.

Jacuzzi Makes New Small Turbine Pump

208

Jacuzzi Bros. Inc., Richmond, Calif., have announced the development of a water-lubricated lineshaft turbine type pump designed to fit into wells of 4 inch diameter and greater. This small turbine can be bought as a complete unit from Jacuzzi dealers, like a jet water system.

To be known as the "Jacuzzi 4", this low cost Jacuzzi Turbine is designed for installations requiring a moderate but consistent water supply. It is suitable for sprinkler or open ditch irrigation and is excellent for all pressure system uses. The "Jacuzzi 4" is available with a variety of motor sizes and h.p. ratings.

Belco Opens Offices in Houston, Texas

Belco Industrial Equipment Division, Inc., Paterson, N.J., has announced the opening of a Texas office at 2009 Fannin Street, Houston.

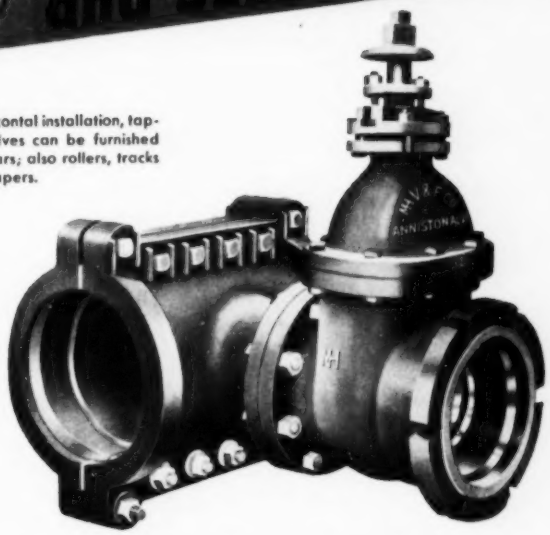
Mr. Joseph Stoy has been appointed branch manager of the Texas office and will handle all phases of water treatment. He is a graduate of Washington University, holding a degree of B.S. in chemical engineering.

Improved Resin for Cement Used in Lining Tanks

209

Irvington Varnish and Insulator Company, Irvington, New Jersey, has developed an entirely new and vastly improved resin used as a chemical resistant cement which not only provides higher tensile strength and less shrinkage, but also provides improved resistance to oxidizing solutions with better water and thermal stability.

FOR TAPPING MAIN UNDER PRESSURE
M-H TAPPING VALVE and SLEEVE



For horizontal installation, tapping valves can be furnished with gears, also rollers, tracks and scrapers.

A. W. W. A.—CLASS C

Designed for tapping a main under pressure to take off a branch larger than corporation cock size. Flange on one side of valve bolts to sleeve; other side of valve may be hub or mechanical joint connection, either of which has special flange cast integral for attaching any standard make tapping machine. Can be furnished with rising stem for use in manhole or valve pit. Features of M & H sleeves are strong, heavy design and liberal length.

M & H Tapping Valve meets specification of A. W. W. A. Class C and Tapping Sleeve is Manufacturer's Standard. For complete information, write or wire M & H VALVE AND FITTINGS COMPANY, Anniston, Alabama.

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

This new resin, known as Fura-Tone 1347, will not crack, check or warp, such as is common with furfuryl alcohol resin. Fura-Tone 1347 also exhibits a notable improvement in shrinkage, according to the manufacturer.

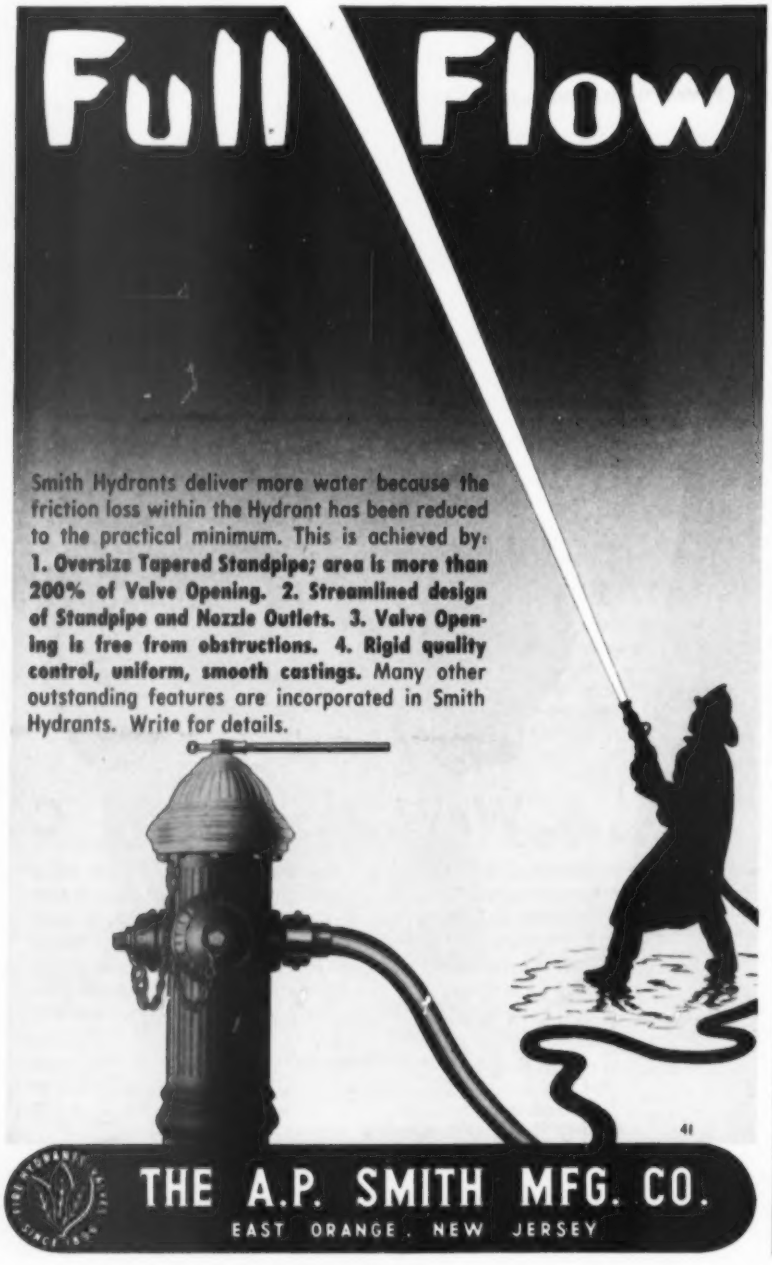
District Managers Appointed By American Cyanamid

American Cyanamid Company, Heavy Chemicals Dept., New York, N.Y., has announced the appointment of three District Managers in a move to improve service to the Department's customers.

Named Eastern District Manager was Mr. J. A. Leek, formerly New York Metropolitan District Manager for the Industrial Chemicals Division. With headquarters in New York City, he will supervise heavy chemical sales in New England and other Atlantic Seaboard states extending as far south as the west part of Virginia.

Serving as Southern District Manager is Mr. E. J. Adams, formerly a sales representative for the Industrial Chemicals Division. He will supervise heavy chemical sales in an area extending from Richmond, Virginia to and including Texas and Oklahoma. Mr. Adams' headquarters will be in Charlotte, North Carolina.

Mr. W. H. Leon, formerly a sales representative for the Industrial Chemicals Division in the Mid-West, was named Western District Manager for the Heavy Chemicals Department. Mr. Leon, with headquarters in Chicago, will supervise sales of the department in the Middle and Far West.


Full Flow
Smith Hydrants deliver more water because the friction loss within the Hydrant has been reduced to the practical minimum. This is achieved by: 1. Oversize Tapered Standpipe; area is more than 200% of Valve Opening. 2. Streamlined design of Standpipe and Nozzle Outlets. 3. Valve Opening is free from obstructions. 4. Rigid quality control, uniform, smooth castings. Many other outstanding features are incorporated in Smith Hydrants. Write for details.
41
THE A.P. SMITH MFG. CO.
EAST ORANGE, NEW JERSEY

A "Curve Assembly" To Convert pH-Meters To Efficient Titrators ●

210

Fisher Scientific Company, Pittsburgh, Pa., has developed a continuous curve chart. This was prepared by plotting changes in pH by means of a "titration curve assembly" that uses a popular pH-meter to assist chemists in setting up controls on any variety of samples. The "shape" of the various curves plus the indicated end-points supply all the answers.

Thus, impurities (like CO_2 in alkaline samples) impress their "fingerprints" on the curve, where they are readily identified by eye.

And not only is the curve a more precise and informative way to gather control data, but with color present it is the only way to gather this data at all.

The "titration assembly" includes a sturdy Fisher burette stand with burette holder, two burettes with curved delivering tips, an electrode support, a 250-ml beaker. Heart of the assembly: a new Fisher magnetic stirrer equipped with two stirring magnets, one polyethylene, one glass-enclosed, which operates on 115 volt 50-60 cycle a-c. Brain of the assembly: a popular Beckman pH-meter.

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WATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

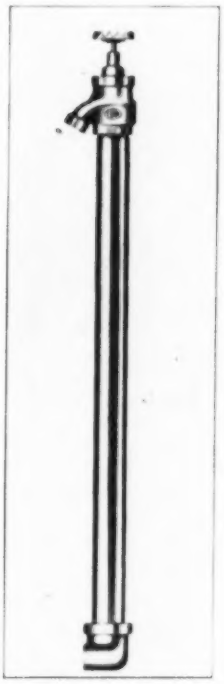
Will see that you receive information desired.

Universal's Miami Plant Opens

Universal Concrete Pipe Company, Columbus, Ohio, has announced that the Miami, Fla., plant under construction since last April, began operations in January.

Located at 1525 Stirling Road, Dania, the Miami operation is expected to service conveniently the area of southern Florida below Lake Okeechobee. It is the 26th in Universal's network of plants in the east and south.

With the latest types of concrete fabricating machinery manufactured by Universal's machinery division in Columbus, the Miami plant will be equipped to manufacture plain pipe in diameters 5 to 30 inches and reinforced pipe from 24 to 120 inches in eight foot and longer lengths. In addition, the plant will produce Flexicore floor and roof slabs and other pre-cast concrete products.



Sanitary All-Weather Yard Hydrant

217

J. A. Zurn Mfg. Co., Erie, Pa., has designed a non-freezing sanitary hydrant that provides for the protection of supply water against contamination. This hydrant had no seep holes, so there is no possibility of water contamination and it is claimed that it will function properly at static water pressures ranging from 25 psi. to 130 psi., and at temperatures ranging from 100° to minus 70° F.

A special rubber sleeve enclosed in the casing insures operation during freezing or low temperature, since movement of the rubber upon the introduction of water pressure breaks up any frozen water inside the casing. The elastic action of the rubber sleeve, when the water pressure is turned on, protects all mechanical parts and the flow of water flushes out residual ice.

The cup-type rubber seat washer insures a positive pressure and a minimum of friction between the sealing parts. All working parts of this hydrant can be removed without disturbing the buried casing. Hydrants are available in ¾ and 1 inch sizes and for any depth of bury from 2 to 9 feet.

Angst Ass't Western Sales Manager for A. C. F.

American Car and Foundry Company, New York, N.Y., has announced that John E. Angst, sales agent for the Company in Chicago, has been appointed assistant western sales manager. Mr. Angst, who will continue to make his headquarters in Chicago, will report directly to John H. VanMoss, western sales manager.

Keeps Chlorine Under Control!

BUILDERS Visible Flow CHLORINIZER combines the two vital design elements that insure complete chlorine control: (1) a chlorine flow regulating system that's easy-to-operate and positive-acting and (2) an easy-to-read, linear scale, visible-flow indicator. You adjust the handy chlorine control valve until the *Sightflo Indicator* shows the exact chlorine feed you need. The Sightflo indicator meters the actual chlorine flow — gives you accurate flow facts that help you keep chlorination operations under complete control at all times.

Get full details on BUILDERS Visible Flow CHLORINIZERS — the *modern* chlorine gas feeders. Write to Builders-Providence, Inc. (Division of B-I-F Industries), 350 Harris Ave., Providence 1, R. I.

BUILDERS-PROVIDENCE

BUILDERS

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pump

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- easily installed
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- introduces atmospheric air up to 3% by volume

write today for complete information

BULKLEY-DUNTON
PROCESSES, INC.
295 Madison Avenue • New York 17, N. Y.

A graduate of Princeton, Mr. Angst was with Oglebay Norton & Co., Cleveland, in the sales department during 1940. In 1941 he entered the Army of the United States and was promoted through the ranks from private to major in the Field Artillery Corps. In 1945 he joined the ACF sales staff as a sales agent in the New York office, being transferred to Chicago in April, 1948.

Chemical Resistant Sewer Joint

212

Atlas Mineral Products Company, Mertztown, Pa., announces the availability of a new ductile, chemical resistant sewer joint for joining vitrified clay pipe waste lines. The standard method used previously utilized a combination of a furane and a plasticized sulfur cement. However, while the combination has given successful service over a period of several years, it was not sufficiently flexible for many specific installations.

The new patented joint is precast on the job using a new hot-poured plastic composition called JC-60. The molds used on the bell and spigot section are designed so that considerable space remains at the base of the spigot and between these two precast components. When the line is laid, these spaces are filled with a newly developed chemical resistant cold-setting cement called VITRO-PLAST. Thus, the resulting plastic joint is both ductile and resistant to all common solvents, acids and other corrosives expected to be found in chemical wastes.

A simple modification of this patented construction consists in the application of a small amount of VITRO-PLAST in the annular space between the bell and spigot followed by a hot-pour JC-60. This construction is accomplished by trowelling a bead of freshly mixed cold-setting plastic cement on the spigot and bell before shoving the spigot home. A runner is then placed against the bell and the joint is poured in the usual manner.

Foxboro Expands Dallas Plant

The Foxboro Company, Foxboro, Mass., has announced that new factory facilities for the assembly of control valves were recently acquired at Dallas, Texas. Convenient to the office address, 1710 N. Akard St., the new quarters practically double the area devoted to valve assembly and warehousing, and will facilitate rapid delivery and service to industries throughout the South and Southwest which have been served from the Dallas Branch for over 20 years.

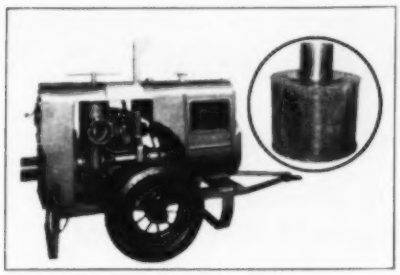
"Fermex" Prevents Clogging of Septic Tanks

213

The Fermex Company, Newark, N.J., has developed a product that liquefies organic waste material in septic tanks by continuously reproducing itself.

Marketed under the trade name of Fermex, the product consists of a newly discovered active ingredient that has been combined with a special fermentation process to continuously reduce organic waste to a liquid, providing all-year-round, trouble-free septic tank operation, in a single, safe application per year, preventing clogging and eliminating the need for pumping out the tank.

Fermex will not affect metal pipes, porcelain, or cement block, and it is used simply by pouring a one quart solution down the toilet bowl and flushing.



Wellpoint and Sump Pump

214

Foundation Equipment Corp., Long Island City, N.Y., announces a 4" Hi-Capacity portable gasoline-engine-driven wellpoint pump. Designated the 646, it has a capacity of 1000 gal. per min. With an eye toward economy, the 646 has been designed to replace the larger units where soil conditions permit. It is unnecessary to pay high purchase, fuel, and maintenance costs for a large pump when this smaller one can do the job more economically.

The 646 has all the efficient and economical operational features of Foundation's 6", 8", and 10" units. Horsepower is more than sufficient, assuring long engine life and low maintenance. Vacuum pump displacement is ample for most wellpoint jobs to guarantee a positive prime at all times and an even flow regardless of the amount of water being pumped. It is not necessary to run the engine at high speeds to keep the prime; this makes for low fuel consumption.

The 646 pump and larger "Foundation" wellpoint pumping units can also be used as sump pumps with the "Foundation" special strainer which effectively prevents foreign materials from entering the centrifugal pumps.

Buchanan Named to A-C Board of Directors

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced the election of William E. Buchanan, president and treasurer of the Appleton Wire Works, Inc., of Appleton, Wis., to the board of directors of the company.

Buchanan fills the vacancy created recently by the resignation of Edmund Fitzgerald of Milwaukee, president of the Northwestern Mutual Life Insurance Co.

A native of Appleton, Buchanan is a director of the First National Bank of Appleton and Appleton Coated Paper Co., and a trustee of Lawrence College, Appleton.

He is also a director and a member of the finance committee of the Chicago and Northwestern Railway Co. and a director and member of the executive committee of Employers Mutual Liability Ins. Co. of Wisconsin.

"Chlorosan" for Control of Filter Flies and Odors

215

A new product of interest to sewage plant operators, sanitary engineers, and health department officials, has been announced by the Los Angeles Chemical Co., of Los Angeles, Calif. The product, "Chlorosan," is the result of a quarter century of research, tested under all conditions during the past year, the company reports. During this time, it has been used in many southern California cities for the control of Psychoda fly in sewage plants and wet wells, and the control of odors from the plant and sludge beds.

Safety and ease of application are outstanding characteristics of this product, the manufacturer states. The material is produced in the form of a concentrated liquid, and can be applied through simple drip equipment, or where necessary, it can be handled

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This tank in some respects looks like hundreds of others, but unlike many, it has a brighter future of longer life and greater service, because it is protected by an Electro Rust-Proofing system.
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Highly trained, backed by a long list of successful installations and years of experience, our engineer is always ready to help you solve your corrosion problem. For complete information, write today.
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SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

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THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

through ordinary spray equipment. Excellent results have also been obtained in controlling odors in sewer lines; grease control in grease traps and sewer lines; and in controlling odors in waste water from food and beverage plants.

Belco Opens New Offices

Belco Industrial Equipment Division, Inc., Paterson, New Jersey has announced that Mr. Martin J. Sherry has been named manager of the company's new California offices located at 4418 Vineland Avenue, North Hollywood.

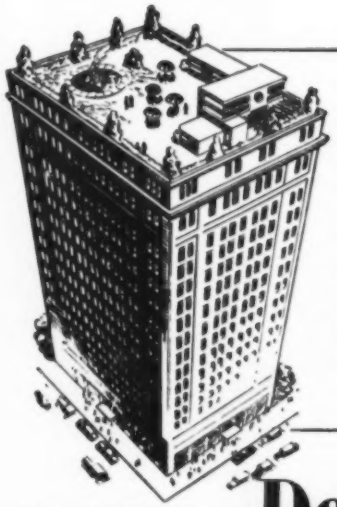
Mr. Sherry is a graduate engineer of the University of Southern California. He holds a BE degree in Mechanical Engineering and has had a wide range of experience as a field engineer in both Power and Chemical fields. For the past four years he represented Belco under the name of the Western Engineering Company of California.

Safety Signs

216

W. H. Brady Co., Chippewa Falls, Wis., manufacturers of Quik-Label pipe and conduit markers has intro-

Detroit's Leading Commercial Hotel



Stay at the newest, most centrally located hotel in the Motor City, completely fireproof, 750 outside rooms with bath, smart new furnishings, lowest comparable rates, ample parking space—a find for the cost-conscious traveler! *Dining Rooms Air Conditioned*

The NEW Hotel **Detroiter**

Woodward at Adelaide, Detroit 1, Michigan

Convention and Touring Groups Invited

duced a new line of self-adhesive Quik-Label safety signs.

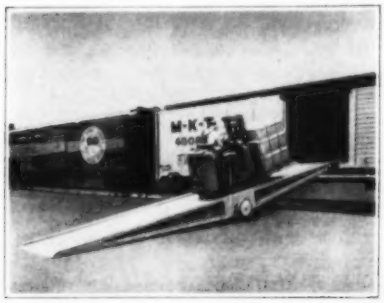
Brady Safety Signs are printed on extra strength cotton cloth which has a self-adhesive backing. The message is shown in large bold letters on the proper safety background color. Each sign is coated with Silicone Plastic which protects it from dirt, grime, moisture and weather. They may be used for either indoor or out-of-door application.

The signs come mounted on handy dispenser cards and may be quickly removed from the card and instantly applied. A wide selection of over 550 different Quik-Label Safety Signs and Pipe Markers are carried in stock for immediate shipment. Special signs are also available with any wording and in any colors desired.

Virden Elected Director of Diamond Alkali

Diamond Alkali Co., Cleveland, Ohio, has announced that John C. Virden, nationally-known Cleveland industrialist, has been elected a director of the company.

Board chairman for the past 16 years of the electrical lighting fixture firm which bears his name—the John C. Virden Co.—the Cleveland industrialist brings to Diamond a broad background in the fields of business and governmental administration built through more than three decades of service. In both spheres of activity he has gained a national reputation as an able administrator and a competent coordinator.



Portable Yard Ramp

217

Magnesium Company of America, East Chicago, Ill., has announced the addition of the Magcoa portable magnesium Yard Ramp to its line of materials handling products.

The Yard Ramp, designed to load and unload freight cars from the ground level, is available in five standard sizes, all of which are 30 feet long but vary in widths of 60 and 70 inches. Capacities range from

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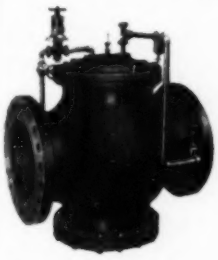

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Flocs resulting from N-Sol Activated Silica used with alum are fast forming, clear *settling* and tough. You need this type floc especially in winter to produce longer filter runs—to reduce turbidity.

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BLACKBURN-SMITH PNEUMATIC SEWAGE EJECTORS

TO LIFT SEWAGE AND SLUDGE AT TREATMENT PLANTS

30 to 500 GPM in both single and twin units against high discharge heads.

Duplex Sewage Ejector, showing inlet piping.

Over 50 years service has proved the rugged worth of Blackburn-Smith Ejectors. Yet our today's product is full of exclusive modern features such as:

1. Float and electrical float switch controls.
2. Float and pneumatically controlled snap action valve.
3. Electrode controls.

Any one of the above, with or without Air Receivers.

Preferred by most prominent consulting engineers as less messy, more sanitary than centrifugal submerged type sewage ejectors or pumps. Ends screen and pump cleaning. Sewage can be lifted straight up—150 feet—any capacity—once a minute, without fail. Catalog S 50

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6,000 to 16,000 pounds, and a large wheel on each side of the ramp perfectly balances the weight, permitting one man to easily push and roll the ramp to the desired position for use.

Wilson Company Appoints Zanders to Staff

Warren M. Wilson Company, Cleveland, Ohio, representatives for Conoflow Corporation, announces the appointment of Harold T. Zanders to their staff of sales engineers.

Well-qualified in the instrument field, Mr. Zanders, who attended Fenn College, has had extensive experience in various capacities in the industry. Formerly a sales engineer with the Bailey Meter Co., Mr. Zanders was later associated with the manufacturers' representatives business.

The Warren M. Wilson Company, who services northern Ohio with Cono Controls, has recently expanded their facilities in a move to larger and more centrally located offices in the Arcade Building in Cleveland.

Power Transmission Equipment Headquarters at Worthington Oil City Plant

Worthington Corporation, Harrison, N. J., has announced that headquarters for the sales, engineering and production of Multi-V-Drives and Allspeed Drives have been consolidated at the Oil City, Pennsylvania, plant of the company.

A new division to be known as the Mechanical Power Transmission Division has been set up to handle Multi-V-Drives, formerly manufactured at Worthington's Buffalo, N.Y. and Wellsville, N.Y. plants, and Allspeed Drives formerly manufactured at Worthington's Holyoke, Mass. plant.

Sales functions of the new division will be under the direction of D. E. Tessendorf, manager, and H. W. Kumro, assistant manager. Fred G. Moore has been named chief engineer of the division, and manufacture of these products will be under the direction of W. F. Weinreich, Works Manager of the Oil City plant.

Some 150,000 square feet of manufacturing and warehousing floor space has been allocated to this consolidated operation.

Thermometer Magnifier

218

Fisher Scientific Co., Pittsburgh, Pa., has made available an ingenious

magnifier which simplifies thermometer reading.

The Fisher Thermometer Magnifier, made of polished plastic, is equipped with a pair of spring clamps that makes it easy to snap onto any standard thermometer. It can be moved up or down to any desired position to magnify a full two inch section of the thermometer.

Instead of peering closely at the thermometer, the operator can now take an accurate reading from as far as 6 feet away, and from a surprisingly wide angle from directly in front of the scale. A hairline, engraved across the center of the magnifier, can be set at the desired temperature to serve as a handy reference point.

Literature & Catalogs

Cooper-Bessemer Catalog Describes Complete Compressor Line

219

The Cooper-Bessemer Corporation, Mount Vernon, Ohio, has just published a new, comprehensive **M-Line Compressor** Bulletin.

This 44-page engineering-type catalog provides basic application data with design specifications on Cooper-Bessemer's complete line of reciprocating compressors from 100 to 5,000 horsepower.

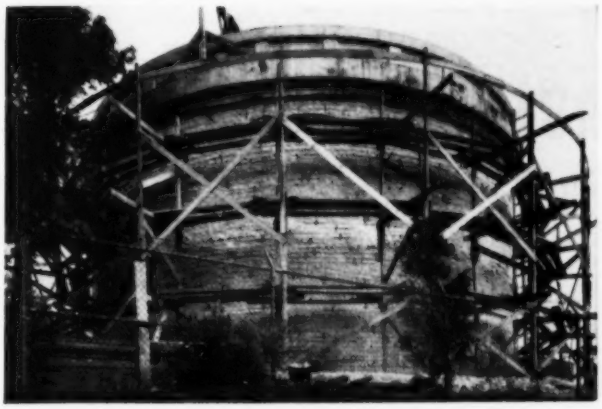
Designed for efficient use on a broad range of industrial air compressing, Cooper-Bessemer compressors are powered by electric motors or internal combustion engines.

Described in the Bulletin are the Type EM, Type FM and Type JM multi-stage and multi-cylinder units.

Liquid Level & Valve Position Indicator

220

Minneapolis-Honeywell Regulator Company, Brown Instruments Division, Philadelphia, Pa., has available a new **Liquid Level and Valve Position Indicators** bulletin that illustrates and describes two new additions to miniature instruments line. According to the bulletin these instruments are explosion proof, and are designed to be mounted so that indicating scales appear in distinctly shaped vessel or valve symbols on fronts of panel boards. Liquid level indicator is said to give illusion of actual sight glass. Actuation of either indicator is by standard 3-15



CEMENT GUN COMPANY PRE-STRESSES AND RESTORES *EXISTING* WATER TANK

The progress picture above shows a stage of our repair work on a concrete water tank in New England. This tank was completely lined with reinforced "GUNITE" to stop seepage which had caused serious disintegration to the exterior of the tank. The entire outside of the tank was subsequently chipped and existing hoop rods exposed.

To strengthen the tank, wedges were driven behind the rods to take up the slack. This placed the rods in tension and the concrete in direct compression. Wire mesh was then attached to the reinforcing rods and the entire tank treated with two inch mesh reinforced "GUNITE."

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, etc., is illustrated and described in Bulletin C 2400. We will gladly send a copy at your request. On your letterhead please.

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MANUFACTURERS OF THE CEMENT GUN

Which butterfly valve better meets your needs?

In either of these or any other valves, manual or automatic, which W. S. Rockwell builds for your exact needs, you're sure to get the right type and size to best meet the conditions of operating pressure, temperature and nature of fluid handled, whether it be air, gases, water, liquid or semi-solid chemical materials.

It will pay you to learn how Rockwell Valves can meet your plant's flow control requirements.

Rockwell stainless steel valve; with air cylinder operator and valve positioner; for throttling gases at 1200° F.

Rockwell heavy duty valve for 50 p.s.i. working pressure; has a replaceable rubber liner for valve body and stainless steel blade; with a motor operator and handwheel declutching unit.

ROCKWELL Valves

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● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

psi pneumatic receiver. The bulletin also includes complete specifications and a dimensional drawing.

Spiragester

221

Lakeside Engineering Corporation, Chicago, Illinois, has just released a bulletin on the **Spiragester.**

The bulletin describes the Spiragester as a unit which combines the excellent settling and skimming features of the Spiraflo Clarifier with a digestion compartment underneath. Page 2 gives a handy reference table on the different sizes and capacities of the Spiragester.

An elevation line drawing and installation instructions are also included.

Laboratory Safety Manual

222

Fisher Scientific Co., Pittsburgh, Pa., has available the new edition of the **Manual of Laboratory Safety.**

The 48-page, illustrated book has chapters on "Accident Prevention," "First Aid," "Fire Prevention" and "Safety Equipment." A safety bibliography covering a wide range of fields, from A (Analytical Chemistry of Industrial Poisons, Hazards and Solvents) to V (Ventilation) is included, as well as a reproduction of the famous Laboratory Emergency Chart (revised edition), which contains, in alphabetical order, rapid treatments for a comprehensive list of laboratory mishaps, both external and internal.

Dual-Fuel and Diesel Engines

223

Nordberg Mfg. Co., Milwaukee, Wisconsin, has available a catalog entitled **"Nordberg Machinery for Many Applications."**

The catalog, in addition to the other products manufactured by the company, devotes 9 pages to a discussion of two-cycle and four-cycle dual-fuel diesel engines. Over 15 photographs of actual installations

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Taylor Model T-O Comparator. Slides for pH as low as 0.2 or as high as 13.6.

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SINCE IOWA 1909

We manufacture complete equipment for water and sewage flow control in Filtration Plants, Sewage Disposal Plants and Pumping Stations. Specify Iowa and let us solve your problems.

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A subsidiary of James B. Clow & Sons

are included along with a page devoted to the Nordberg radial Dua-fuel engine.

Recorders and Indicators

224

Minneapolis-Honeywell Regulator Company, Brown Instruments Division, Philadelphia, Pa., has published a Catalog containing factual information concerning **ElectroniK Recorders and Indicators,** which employ a potentiometer, Wheatstone bridge, or other measuring circuit to measure temperature, pressure, flow, pH and a host of other variables.

Actually a handbook for engineers' and buyers' use, the literature presents detailed specifications for each particular model. Also included is information on specially adapted ElectroniK instruments such as the Electrometer, Function Plotter, Scanning System, "TV Dial" Recorder, Double Range Precision Indicator, and Console Desk Precision Indicator.

Telemetering Bulletin

225

Automatic Control Company, St. Paul, Minnesota, in the current issue of the Autocon Rambler discusses **Telemetering.**

The bulletin defines Telemetering . . . outlines some typical Telemetering applications . . . and especially enlarges on Telemetering systems for water and sewage applications, although a system can be designed for dozens of applications which require simple, foolproof design.

Controls For Liquids and Gases

226

Simplex Valve & Meter Co., Philadelphia, Pa., has just published a catalog on **Measurement and Control of Liquids and Gases for Water and Sewage Works, Power and Process Industries.**

This complete and well illustrated booklet containing 32 pages, lists many types of controllers, gauges, manometers, valves, venturi tubes, etc.

Descriptions of the units, their operating characteristics, construc-

FOR SALE—½ PRICE

Fluoridation equipment—2 years old in excellent condition.

2 Hills McCanna Proportioneer pumps—¾ H.P. Motor, Lightnin' Mixer and 100 gal. stainless steel tank.

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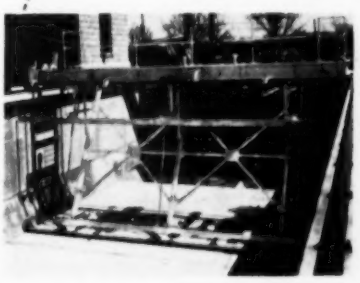
FOR SEWAGE AND TRADE WASTES



Particularly suitable where space is limited or where sludge delivery is desired at one end of tank. Consists of a bridge crane spanning width of the tank, supporting sludge scraper and skimmer, which moves automatically back and forth.

Many of these units are now operating in sewage plants throughout the country.

This unit has also proven highly successful as an oil-water separator in the treatment of oil refinery waste water. Bulletin 31-D-15.

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FOR **MODERN ANALYSIS** of WATER and SEWAGE

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accurate
simple
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HELLIGE, Inc. 877 STEWART AVENUE GARDEN CITY, N. Y.

tion details, mountings, specifications and other data of interest to consulting plant engineers, purchasing engineers and operating personnel are listed.

Portable Gasoline Hammer

227

Barco Manufacturing Co., Chicago, Ill., has just published a bulletin entitled—**"A Profitable Tool with Many Uses."**

The bulletin describes applications for the company's portable gasoline powered hammers in the utility, telephone, municipal, mining, military, factory maintenance, and general construction fields. Typical applications include concrete breaking, asphalt cutting, frost breaking, ground rod driving, rock drilling, stake driving, grave digging, sheathing driving, and a variety of utility jobs.

According to the bulletin the new models feature an improved ignition system which facilitates easy starting and stopping. Standard hammers deliver up to 1700 strokes per minute with a gasoline consumption of approximately a quart an hour.

Plastic Pipe Brochure

228

The Plastic Products Division of Triangle Conduit & Cable Co. Inc., New Brunswick, New Jersey, has just published a 16 page brochure on **Plastic Pipe.**

The brochure contains all pertinent information on Triangle's four types: Flexible, Semi-Rigid, Rigid High Impact and Rigid Polyvinyl Chloride Pipe. Detailed tables give chemical and physical characteristics of each type. Also included are advantages of using plastic pipe and simple directions on how to install and join the pipe.

Autocon Selectrols

229

Automatic Control Company, St. Paul, Minnesota, has just published a bulletin on **Autocon Selectrols.** This bulletin covers the Type M Autocon Selectrols which are used for water, sewage, irrigation and flood control systems. Feature of the Type M Selectrol is that one float can provide a coordinated operation of 2 to 18 (or even more) pumps, valves, etc.

Page 2 shows a typical operating schedule and Page 3 contains a complete range of units with typical installation plans.

Page 4 provides a Selectrol chart with dimensions and typical specifications.

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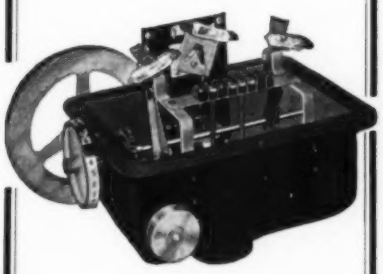

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Tractors and Air Compressors

230

Le Roi Company, Milwaukee, Wisconsin, has available a large catalog on **Le Roi Products for the Construction Industry.**

Beautifully lithographed, the catalog discusses the basic tractor and air compressor units along with the available attachments for digging, backfilling, pipe handling, caulking, tamping, etc.

Amply illustrated with photographs and drawings, sections of the catalog are devoted to Le Roi equipment usage in water and sewage projects.

Bailey Control Panels

231

Bailey Meter Company, Cleveland, Ohio, has published an 8-page bulletin on **Control Panels** that discusses the engineering and economical planning of modern combustion and process control panels.

Numerous panel designs, fashioned for control, are illustrated along with the most up-to-date methods of tubing and wiring. A section on panel accessories of utility and appeal combine to make a valuable source book of ideas for control station planners.

Head Loss Data On Carlon Plastic Pipe

232

Carlon Products Corporation, Cleveland, Ohio, has announced that authoritative data has been compiled on head loss due to friction in CARLON plastic pipe and is available in the form of charts and graphs. These are based on a combination of Carlon's own experience and a compilation of data derived from a thorough check of flow properties by the foremost hydraulic laboratories throughout the country. The graphs covering water flow vs. head-loss for both CARLON plastic pipe and steel pipe show that the flow characteristics of CARLON are from 50 to 60% better.

The apparent reason for the superior flow characteristics of CARLON plastic pipe is that it is not "wetted" by water as steel pipe is, and therefore little adhesion between the liquid and pipe interior is encountered. It can be said also that the pipe does not have as great an adhesive grip to the forward motion of the liquid. This combination of smooth interior and nonwetting produces a condition that approaches perfect pipe flow. Because the interior walls of CARLON pipe

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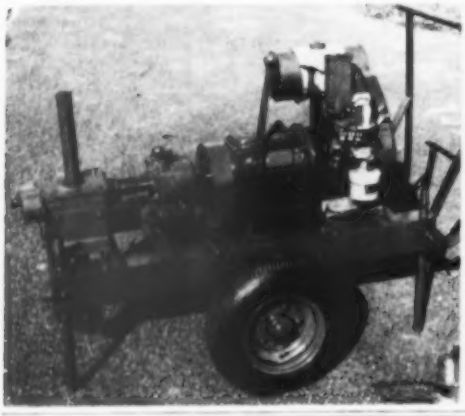

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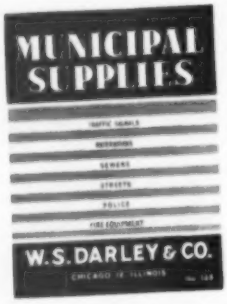

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will not accumulate scale or sediment, this superior flow characteristic remains constant for the life of the pipe. As a result of this lower friction loss, generally plastic pipe in one diameter size smaller than steel can be used at equivalent pressure for the same flow.

New Pneumatic Controller

233

Fischer & Porter Company, Hatboro, Penna., has available a new catalog describing a completely new **P-4 PNEUMATROL Pneumatic Controller** for rate of flow, differential pressure, liquid level, viscosity, pressure, and temperature applications. This controller is usable for either single or dual instrument case mounting and for point-of-measurement installation as well. This catalog describes in detail the action and components of this controller.

According to the catalog the P-4 PNEUMATROL unit is a true motion balance controller and not the force balance system commonly employed in point-of-measurement (stack) controllers. It is available in all modes of control including on-off, narrow band proportional, and wide band proportional with manual or automatic reset and with or without derivative action.

New Bulletin on Cleveland Trencher

234

Cleveland Trencher Company, Cleveland, Ohio, has just published a new bulletin fully describing the **Cleveland Baby Digger Model 95 Trencher.** The bulletin stresses job applications and outstanding features.

Center-spread of the 8-page, 2-color bulletin is a detailed study of Cleveland design, materials, and construction. Complete information is provided on component parts—from the powerful 320 cu. in. engine to the rooter tips of the buckets. A numbered outline photograph positions each important part.

Plenty of on-the-job photographs show the 95 operating under various job conditions—on all types of trenching projects.

Complete dimensions and specifications are given, including tables of optional trench widths and digging wheel and traction speed combinations.

Frame Type Centrifugal Pump Bulletin

235

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a

new bulletin on **Allis-Chalmers Frame Type Centrifugal Pumps.**

The bulletin discusses how these pumps, designed to handle most ordinary pumping jobs requiring capacities up to 500 gpm and heads as high as 135 feet, are built for V-belt drive, and the frame type can be mounted in a variety of positions and connected to any type of prime mover without difficult alignment problems.

Cross section diagrams of the three available types of frame type centrifugal pumps showing the units' rigid cast iron frame, two single row ball bearings, mechanical seal, and slinger and seal assembly, together with performance curves, are included in the bulletin.

The Story of Homelite

236

Homelite Corporation, Port Chester, New York, has just published a booklet that tells **The Story of Homelite.**

The booklet discusses in detail the highlights in the history of the company and portable power. Growth of the company in both plant space and gross sales are given in chart form. Photographs show both plant and administrative facilities along with the company executives and key employees.

The balance of the booklet shows the complete line of Homelite products and pictures the equipment in operation.

Aluminum Grating

237

Washington Aluminum Company, Baltimore, Maryland, has recently published a folder on extruded one piece **Aluminum Grating.** The folder gives basic mechanical information and covers the features of this material.

According to the company, Aluminum grating is enjoying considerable acceptance in Sewage Disposal Plants, Water Works, Refineries, Chemical Plants, and in other applications where corrosion resistant flooring is important. Waco Grating is light, tarnish free, easy to install, and features non-skid safety for walkways.

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Plant Operators are all talking about the Low Maintenance Costs with

DORR CLARIFIERS

And the talk is based on *fact* . . . actual studies of Dorr Clarifiers in operation over a period of years.

For example, look at Cleveland, Ohio's Easterly Treatment Plant — where sixteen 112′ dia. Dorr Clarifiers have been in operation since 1932. The figures below are based on actual and accurate plant records — and they're typical of the kind of repair costs you can expect with Dorr units.

Repair costs are one of the primary factors upon which Clarifier excellence should be judged. Are you getting the best?

We'd like to tell you how Dorr Clarifiers stack up on performance too. Ask a Dorr Engineer for the facts.

16 Dorr Sifeed* Clarifiers, for handling 123 M.G.D. of activated sludge at Easterly Treatment Plant, Cleveland, Ohio.

*Reg. U. S. Pat. Off.

13-Year Repair Cost Record for 16 DORR Clarifiers

Years of Operation	13
Total Repair Cost	$848.83
Repair Cost *per unit*	$ 53.05
Repair Cost, per unit, *per year*	$ 4.08
% of Original Cost spent for all repairs in 13 years	0.6%

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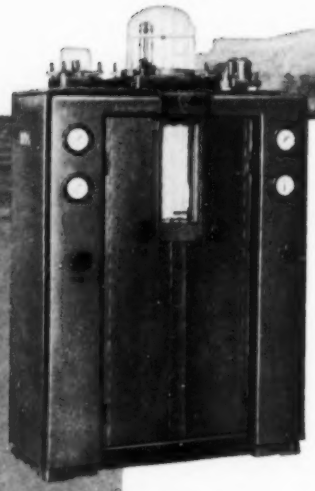

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